

SUBMITTAL COVER SHEET			DATE: 9/28/2016	<input checked="" type="checkbox"/> NEW SUBMITTAL <input type="checkbox"/> RESUBMITTAL	0430105-206
TO:	(Owner) Arlington County: 3201 S. Eads Street Arlington, VA 22202 (Architect) STV, Inc. - 2722 Merrilee Dr. Suite 350 Fairfax, VA 22031 (Engineer) Atkins N. America, Inc. - 2318 Mill Rd., Suite 1040 Alexandria, VA 22314	FROM:	W. M. SCHLOSSER CO., INC. 2400 51ST PLACE HYATTSVILLE, MD 20781		
ATTN: Rami Natour, Jeremy Jenkins, Patrick Standiford, George Clark			ART Bus Facility and Streetscape Improvements Contract Agreement 722-15		
ITEM NO.	DESCRIPTION OF ITEM SUBMITTED	Subcontractor, Manufacturer, Supplier	PROJECT SPEC SECTION	REVIEW CLASSIFICATION: A/E=ARCHITECT/ENGINEER/MIN APPROVAL I=INFORMATION ONLY	NO. OF COPIES P=PAPER E=ELECTRONIC
	CNG Facility and Operations			A/E	1E
	CNG - Natural Gas Dryer O&M Manual	(Sub)Clean Energy	0430105	A/E	1E
Clarifications, Deviations and Comments: This is a preliminary submittal only. Final O&M manuals will be submitted as a package per spec section 017823 - Operational and Maintenance Data. - CC, WMS			I HEREBY CERTIFY THAT THE EQUIPMENT, MATERIAL AND/OR ARTICLE SHOWN/MARKED IN THIS SUBMITTAL IS IN COMPLIANCE WITH THE CONTRACT DRAWINGS AND SPECIFICATIONS, CAN BE INSTALLED IN THE ALLOCATED SPACES AND IS APPROVED FOR USE.		
			NAME AND SIGNATURE OF CONTRACTOR		
			Chris Chapman, WMS		
***** THIS SECTION FOR OWNER / ARCHITECT / ENGINEER USE ONLY *****					
NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY			DATE IN:	DATE OUT:	
NAME: _____			ACTION TAKEN BY CONSTRUCTION MANAGER (CHECK APPLICABLE BOX): <input type="checkbox"/> APPROVED (A) <input type="checkbox"/> APPROVED AS NOTED (AAN) <input type="checkbox"/> DISAPPROVED, REVISE AND RESUBMIT (RR) <input type="checkbox"/> INFORMATION ONLY/NOT REVIEWED (FIO)		
TITLE: _____					
SIGNATURE: _____					

Single Vessel
NGV Fuel Gas
Dryers

Large NG-SR

PSB MODEL: NG-SR- 21- 4-DDP
S/N: 352207

INSTRUCTION MANUAL

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CAUTION

IMPORTANT STORAGE INSTRUCTIONS

IF FOR ANY REASON THIS EQUIPMENT IS NOT ENTERED INTO SERVICE BEFORE 30 DAYS FROM DATE OF SHIPMENT, THE ELECTRICAL CONTROL ENCLOSURE(S) MUST BE PROTECTED FROM HAZARDS OF DAMP ATMOSPHERE WHEN STORED EITHER INDOORS OR OUTDOORS.

MINIMUM PROTECTION WOULD REQUIRE CHANGING DESICCANT BAGS, PLUGGING ALL OPENINGS AND SEALING ALL ELECTRICAL CONTROL ENCLOSURES WITH WATERPROOF MATERIAL OR PURGING WITH DRY INSTRUMENT AIR.



SAFETY NOTICE - DANGER

1. PURGE THE SYSTEM TO REMOVE OXYGEN (CONTAINED IN AIR) PRIOR TO STARTUP.
2. MAKE SURE ALL BLOCK VALVES TO GAUGES ARE OPEN BEFORE ACCURATELY READING PRESSURE GAUGES.
3. DO NOT OPEN ANY PORT UNTIL SYSTEM HAS BEEN FULLY DEPRESSURIZED.
4. DO NOT OPEN HIGH VOLTAGE PANEL WITH AREA KNOWN TO HAVE HAZARDOUS GAS PRESENT.
5. LOOSEN HEATER SUPPORT BOLTING BEFORE REGENERATING UNIT.
6. BURN POTENTIAL HAZARD EXISTS. WEAR PROTECTIVE CLOTHING WHEN WORKING IN AND AROUND UNIT.



! WARNING

- READ ALL INFORMATION IN THIS MANUAL BEFORE BEGINNING INSTALLATION OR OPERATION OF THE DRYER.
- BEFORE STARTING INSTALLATION AND/OR MAINTENANCE PROCEDURES; DISCONNECT POWER TO THE DRYER AND COMPLETELY DEPRESSURIZE THE UNIT TO PREVENT PERSONAL INJURY.
- DO NOT REMOVE, REPAIR, OR REPLACE ANY ITEM ON THIS DRYER WHILE IT IS UNDER PRESSURE.
- NEVER OPERATE THIS DRYER ABOVE THE RATED OPERATING CONDITIONS. OPERATION ABOVE SPECIFIED CONDITIONS WILL RESULT IN DECREASED PERFORMANCE, POSSIBLE DAMAGE TO THE UNIT AND/OR PERSONAL INJURY.
- SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.
- WARRANTY IS VOIDED IF MODIFICATIONS ARE MADE WITHOUT THE APPROVAL OF THE MANUFACTURER.
- EXPLOSION HAZARD. DO NOT REMOVE OR REPLACE FUSES OR OTHER COMPONENTS UNLESS POWER HAS BEEN DISCONNECTED OR THE AREA IS KNOWN TO BE FREE OF IGNITIBLE CONCENTRATIONS OF FLAMMABLE GASES OR VAPORS.
- **DRYER POWER SWITCH MUST BE IN OFF POSITION WHEN NOT IN REGENERATION CYCLE.**



****THIS APPARATUS IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUP D or UNCLASSIFIED LOCATIONS****

I. INSTALLATION AND INSPECTION

A. Inspection

Note: All piping and electrical connections should be checked to insure they have maintained their integrity during shipping and installation.

All dryers are tested and inspected at the factory prior to shipping. Inspect the dryer carefully upon arrival and note any damage on the freight bill. Uncrate and inspect for concealed damage. File claims with the carrier immediately and notify PSB service department.

B. Dryer Location

Locate the dryer outdoors or in a well ventilated area and readily accessible for maintenance. The dryer should have minimum 36" clearance on all sides. The area should be clean, well lit and have a level, vibration free foundation. For standard applications, ambient temperatures should range between 35°F and 100°F. Consult the factory concerning applications outside this temperature range.

C. Filtration



IMPORTANT! Desiccant dryers are designed to remove water VAPOR only!

The inlet gas to be dried must pass through a Coalescing Pre-filter to remove entrained condensate and oil to prevent fouling of the desiccant. Liquid condensate entering the bed will lead to overloading of the dryer, poor dew point performance, and rapid deterioration of the desiccant. Oil entering the desiccant bed may permanently reduce the capacity of the desiccant. A Particulate After-filter should be provided to prevent desiccant dust from traveling down stream. Desiccant dust may cause contamination and excessive wear to equipment. Differential pressure indicators are installed on filters for monitoring of elements.

D. Process Piping

Skid should be kept free of all transmitted vibrations. Piping on unit is self-supporting and is not be used to support any other components.

E. Electrical

Electrical leads shall be connected per Electrical Schematic. Wiring shall be in accordance with local, national and other governing electrical codes. After the appropriate electrical connections have been made, check to ensure proper rotation. Refer to electrical schematic for proper connections.



CAUTION: Unit must be phased to provide proper blower rotation.

Blower fuses have been removed to prevent possible damage to blower vanes during dryer rotation check. DO NOT turn ON blower circuit breaker (CB2) until rotation of the cooler fan has been verified. Proper air flow through cooler is towards motor. If incorrect, then change incoming power wires. DO NOT change factory wiring.

F. Desiccant Charge

The vessel is factory filled with Molecular sieve. **NOTE:** New desiccant will initially adsorb mercaptans. To maintain odorant at the dryer exit, slightly open bypass valve V7 during initial operation or open optional mercaptan bypass valve.

G. Electrical Heater

The unit is equipped with an electric heater. Before applying power, the heater must be checked with an insulation resistance tester. All circuits must indicate a minimum resistance reading of 50,000 ohms between each circuit phase and ground. If any circuit does not meet this requirement, connect 120VAC to circuit for several hours, and then recheck. Repeat this procedure if necessary.

H. DDP (Digital Dew Point transmitter)- if equipped with “DDP” option

Install the Xentaur Digital Dew Point transmitter/sensor. This is a “blind” sensor that provides signal to show Dewpoint temperature on operator display.



For accurate dewpoint measurement, it is important to close V6 slightly to force gas across DDP sensor. Usually 10-15 degree closure on valve handle is sufficient.

Refer to Xentaur manual for details on maintenance, and operation of Digital Dew Point transmitter.

I. Drainage

Connect the pre-filter and sump tank drain valves to a liquid/gas recovery system. These components require draining after each regeneration.

J. Relief Valve

Relief valve should be piped to a safe location.



DANGER: A block valve is located at the inlet of PRV that MUST be locked open prior to commissioning. Closing of block valve during operation could result in serious injury or death.

K. Low Pressure Installations

For dryers designed with operating pressure below 10 psig, customer must supply a small (tubing) pressurization line from higher pressure source. This will ensure that regeneration pressure is high enough. Regeneration circuit can be pressurized through blower housing valve V13.

II. SAFETY

- A. Dryer Power switch to be in OFF position when not in regeneration cycle.**
- B. Use EXTREME CAUTION when working in the vicinity of the dryer.**
- C. Relieve pressure before servicing dryer or associated equipment.**
- D. Make sure that the relief valve is locked open before operation.**
- E. Disconnect power before servicing dryer.**
- F. Manual drain valves will eject water, oil, particulates and gas under partial pressure when operated. Proper precautions must be taken.**
- G. Condensate may contain oil or other contaminants. Follow all applicable regulations for safe handling and disposal.**
- H. Purge the system to remove oxygen (contained in air) prior to startup.**
- I. Keep electrical closures closed and bolts tightened securely.**

III. DRYER CONTROLS

A. Dryer Power Selector switch (SS1)

This selector switch, when moved to OFF position, removes all control power from dryer except for enclosure heater (optional), heat trace (optional), and moisture analyzer. All dryer action stops immediately. Rotating switch to ON position restores control power but does not start dryer. Wait momentarily to allow PLC to power to ready state.

B. Emergency Shutdown pushbutton (ESD1)

Push-pull operation should be wired in series with other plant ESD buttons. Plant master control relay contacts should be wired in with dryer control system to remove power from dryer in an ESD condition. Refer to electrical schematic for details.

C. Dryer Alarm Light (1LT)

Should an alarm occur, this light will illuminate or flash depending on severity of alarm. Steady ON is an alarm that needs immediate attention. Flashing ON is an alert that maintenance is needed, or condition has occurred where operator action is needed to improve quality of dryer operation. Refer to alarms (section XI) for details. Dryer alarms listed include: Heater sheath over-temperature, Heater outlet temperature high, Cooler outlet temperature high, Cooler/Blower overload, Thermocouple failure, and communication failures. These are shown on operator terminal display under alarm page.

D. Operator Control Station

A display is present on control panel face that enables operator to gain valuable information about status of dryer, enables operator to change setpoints, and aids troubleshooting should an alarm occur. Changing setpoints is protected by password to prevent tampering. Refer to operator terminal (section IV) for details.

E. Function Key Controls

At the bottom of operator control station, there are four (4) function keys that give operator control of unit. These keys are directly connected to PLC. Key functions are as follows. Refer to operator terminal (section IV) for details.

F1 key – Dryer regeneration control.

F2 key – Regeneration cycle control.

F3 key – Alarm reset.

F4 key – Message control.

F. Operator Display Messages

The display has messages to prompt operator action or add feedback to operator on action taken. These automatically are triggered based on preset conditions. F4 key can be used to review these messages. Maintenance messages popup to prompt operator/maintenance staff action. Additionally, troubleshooting aids can be accessed to enable operator to problem solve.

G. Regeneration Code

In order to prevent unauthorized regeneration activities, a 4 digit code must be entered during the regeneration start process. This 4 digit code is received when registration of unit is complete. Code is required for each regeneration.

To start regeneration, press F1 key. Next, enter regeneration code. Then press and hold F1 key for 2 seconds.

H. Heater Control & Protection

Heater control is accomplished from TE-4 that turns heater ON and OFF based on whether outlet temperature is above or below setpoint (below = heater ON).

Protection of heater is monitored by TE-5 which is connected to heater element. These type “J” thermocouples provide inputs to the PLC control system for alarms and heater control. When a thermocouple burns out (opens), the PLC up scales the input and triggers a shutdown to prevent thermal runaway.

I. Heat Termination Control

This control minimizes heat time based on bed outlet temperature (TE-2). When desiccant moisture is low, the heat front moves through desiccant rapidly.

Therefore, the bed outlet temperature rises quicker than normal. The control stops heating when bed outlet gets to approx. 250°F. This temperature setpoint is preset at factory but can be adjusted if needed (see Section IV).

J. Cooler Ambient Control

To minimize freeze up conditions, cooler motor shuts off when process temperature drops to 40°F. When process temperature rises to 55°F, then cooler motor resumes operation. Cooler outlet thermocouple (TE-3) provides input to control. Control monitors temperature and will temporarily reset control to 50°F OFF temperature to keep from freezing condensate in low ambient conditions.

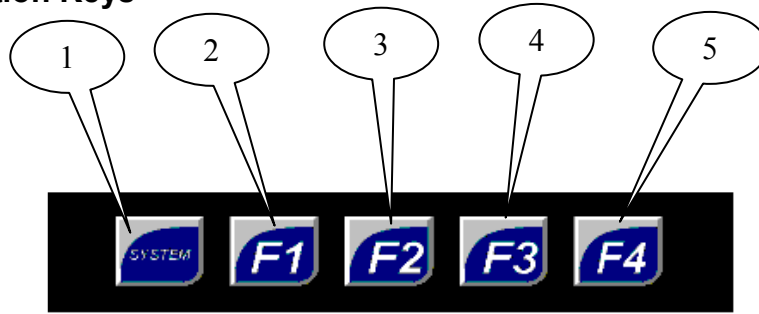
K. Cooler /Blower Motor Overload

Both the blower and cooler motors are protected from overload. These devices are set to NOT require opening high voltage panel to reset. Should the blower or cooler overload trip, the regeneration sequence stops and heater contactor is de-energized. After approx. 2 minutes, the overload resets and alarm can be cleared. Then the dryer sequence can be restarted.

- L. Heater /Blower Interlock**
The heater is electrically interlocked with blower and blower circuit breaker. Should the blower overload trip, the heater contactor is de-energized with blower contactor. If circuit breaker is turned OFF, then blower and heater will not operate.
- M. Compressor Run Monitor**
Since dryer capacity is based on compressor run time, an input from compressor can accumulate run time in dryer and ultimately trigger message to regenerate dryer. This feature provides a secondary feature to prompt operator to initiate regeneration. Refer to section IV and electrical schematic for further details.
- N. Heater Chamber (TE-6)**
The heater is equipped with a control that monitors heater chamber temperature. This control is considered a safety that is external to the PLC and interrupts heater contactor should temperature exceed 500°F. For more detailed information see section XI
- O. Enclosure Heater (optional)**
For applications that are installed in ambient temperatures lower than 32°F, the low voltage enclosure contains a heater to keep PLC and components above minimum operating temperatures. A temperature sensor is mounted to back panel that keeps panel between 40-60°F.
- P. Heat Trace (Sump tank) (optional)**
For ambient temperatures below 35°F, the sump tank is electrically heat traced and covered by insulation. Heat trace cable automatically adjusts heat output to keep un-drained water from freezing. A light located on connection box mounted on tank indicates that power is applied to heat trace cable. A temperature switch monitoring ambient temperature prevents power consumption during periods of warm weather. For safety concerns, a ground-fault protection device prevents equipment damage should a fault occur

IV. OPERATOR DISPLAY TERMINAL

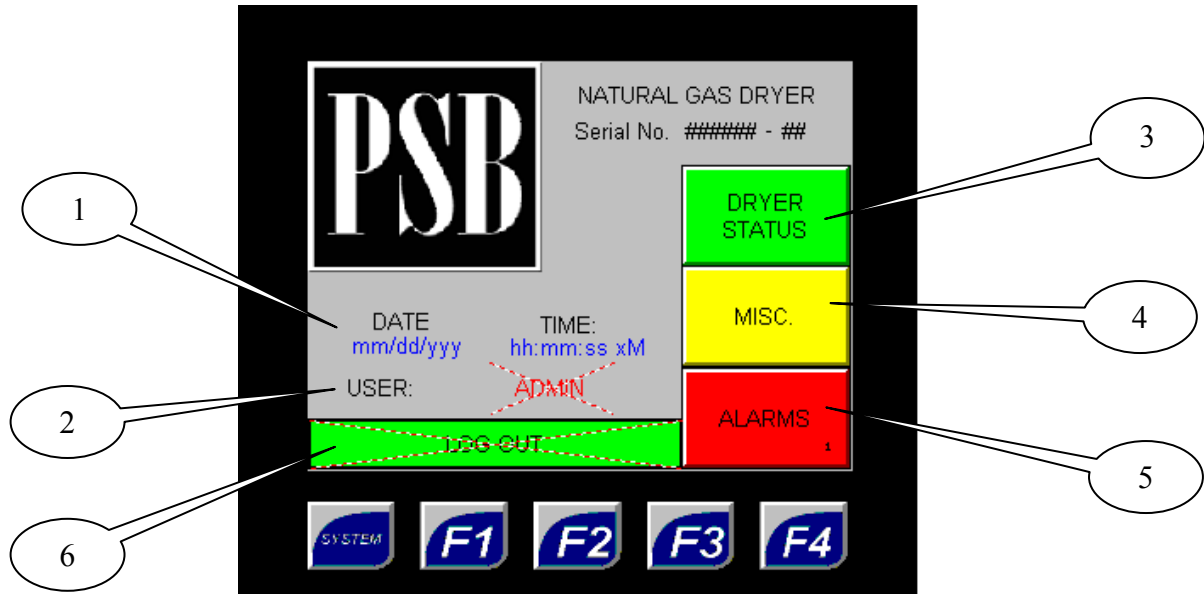
A. Function Keys



Much of the control of dryer requires use of function keys located on operator display near bottom. These provide direct input to PLC.

Item	Object	Description
1	System key	This key allows access to system parameters of PLC and display. This button overrides any other screens and is not password protected.
2	F1 key (Regen control)	Pressing this key will start and pause regeneration cycle. Pause feature is active for 10 minutes. When time expires, then regeneration code needs to be re-entered. Final key press to start unit requires 2 second press. A delay in this process will require redo of sequence.
3	F2 key (Sequence advance)	Pressing and holding this key for 5 seconds will change sequence from heating to cooling and reset sequence to beginning. Sequence change from heat to cool is done when sequence is running. Reset of sequence is done with sequence stopped and Dryer Power switch ON.
4	F3 key (Alarm reset)	Pressing this key resets any active alarms.
5	F4 key (Message review)	Pressing this key allows operator to review messages and alarm displays that have been triggered. Up to 15 screens/alarms are saved in the order they were triggered. After selecting message type, each press of key will view previous message.

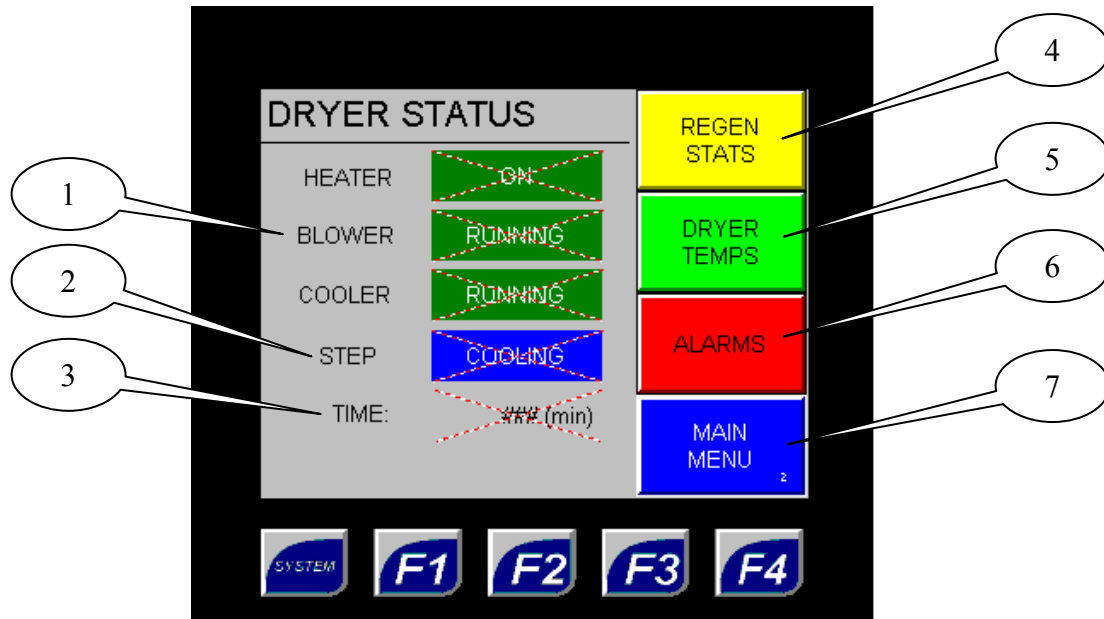
B. Main screen (startup)



This screen is shown at startup and is considered the main screen from which all others are called from. Screen shows user logged in and current time and date.

Item	Object	Description
1	Time/Date indicator	This shows the current PLC time and date. Is used for Alarm reporting purposes.
2	User/Password entry	Two user levels exist; Operator – has ability to view all screens except setpoints. Admin – has capabilities of Operator and can change setpoints, password, and date & time. Password: is “1234”
3	Dryer Status pushbutton	When pressed, screen appears to view operation status of dryer that includes regeneration cycle time, blower/cooler status.
4	Misc. pushbutton	When pressed, screen appears to select Setpoint, Communication, I/O Status, Event History screens.
5	Alarm History pushbutton	When pressed, alarm history screen shows current status. If flashing, then an alarm is active.
6	Log Out pushbutton	This button is visible when “ADMIN” user level is active. When pressed, “OPERATOR” user level is activated.

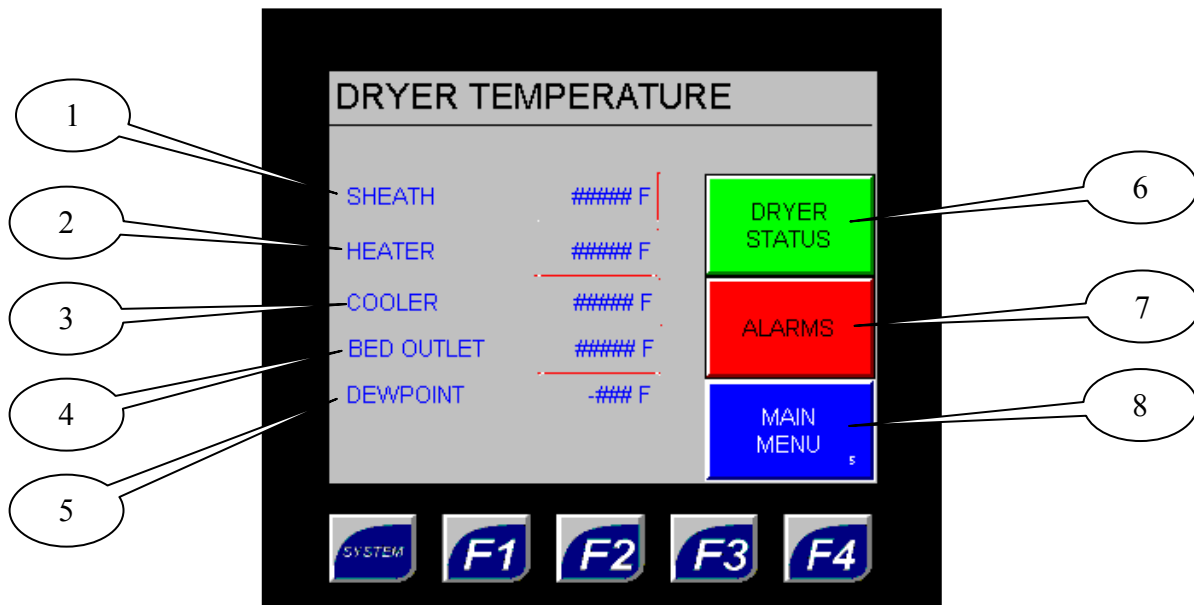
C. Dryer Status screen



This screen provides overall general information on dryer conditions. During regeneration process, accumulated time and current step are shown. This screen is useful in reviewing current dryer status for troubleshooting.

Item	Object	Description
1	Heater/Blower /Cooler Status indicator	Shows whether "RUNNING" or "STOPPED" (Blower/Cooler). For Heater, indicator is "ON" or "OFF".
2	Regeneration Step indicator	When unit is regenerating, "HEATING" or "COOLING" is shown. If not regenerating, then blank.
3	Cycle time indicator	During regeneration cycle, accumulated time is shown in minutes.
4	Regen Stats indicator	When pressed, regeneration statistics screen appears to show quality of regeneration.
5	Dryer Temps pushbutton	When pressed, T/C Temp screen appears to show temperatures of dryer.
6	Alarm History pushbutton	When pressed, alarm history screen shows current status. If flashing, then an alarm is active.
7	Main Menu pushbutton	Returns to main menu screen.

D. Dryer Temperature Screen

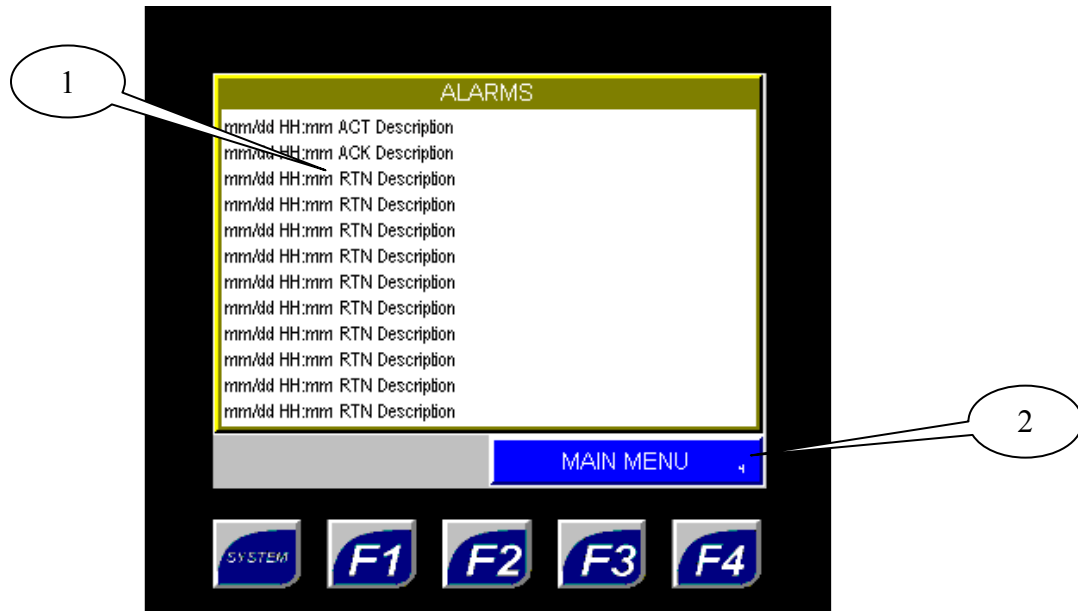


This screen shows the actual pressure and temperatures of dryer. These enable operator to determine potential problems that could occur prior to actual alarm conditions.

Item	Object	Description
1	Heater sheath temperature indicator	Heater elements are monitored by TE-5 and actual temperature is shown. If thermocouple fails, then "FAILED" is shown.
2	Heater outlet temperature indicator	To control heater output, TE-4 monitors and turns heater ON and OFF. Actual output temperature downstream of heater is shown. If thermocouple fails, then "FAILED" is shown.
3	Cooler outlet temperature indicator	Gas temperature downstream of cooler is monitored by TE-3. Actual temperature shown indicates operation of cooler. If thermocouple fails, then "FAILED" is shown.
4	Bed temperature indicator	Gas temperature exiting desiccant bed is monitored by TE-2. Actual temperature shown provides operator quality of regeneration – higher the temperature, the more moisture that is removed from desiccant bed. If thermocouple fails, then "FAILED" is shown.
5	Dewpoint temperature indicator	Outlet moisture content is shown in degrees F. This temperature is monitored by ME-1.
6	Dryer Status pushbutton	When pressed, screen appears to view operation status of dryer that includes regeneration cycle time, blower/cooler status.

Item	Object	Description
7	Alarm History pushbutton	When pressed, alarm history screen shows current status. If flashing, then an alarm is active.
8	Misc. pushbutton	Returns to miscellaneous screen.

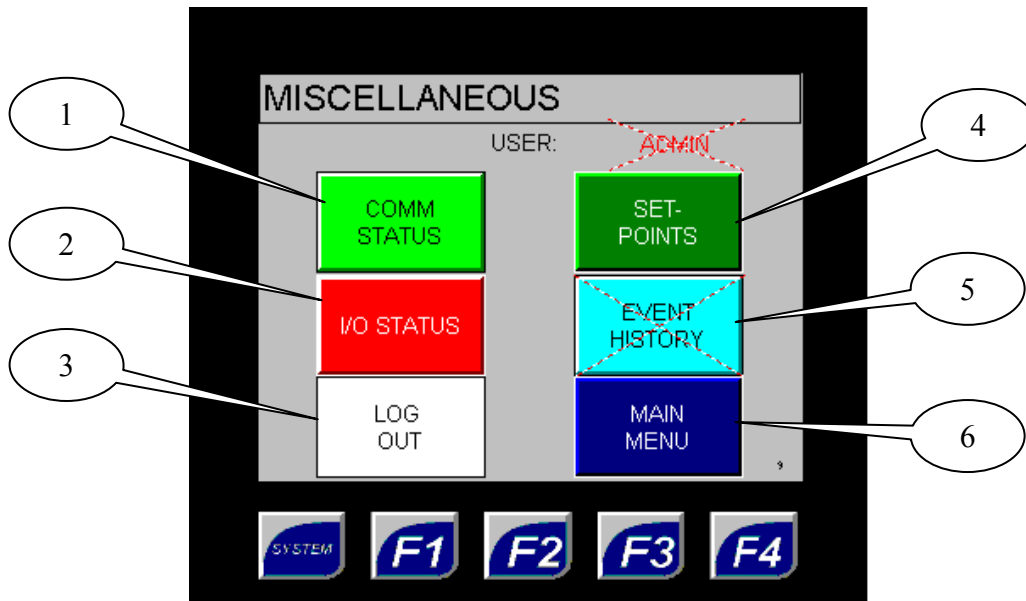
E. Alarm History screen



This screen shows the alarms that are past and current alarms. Touching screen brings up a screen that allows clearing and acknowledging of alarms. When power is cycled to screen, alarm history is cleared.

Item	Object	Description
1	Alarm Summary indicator	Alarms are shown with date and time and current status with description. Status of alarm can be "ALM", "ACK", "RTN". "ACK" status occurs when acknowledgement has occurred from touching screen and pressing "ACK button". "RTN" occurs when the I/O point has returned to normal and ALARM RESET pushbutton has been pressed.
2	Main Menu pushbutton	Returns to main menu screen.

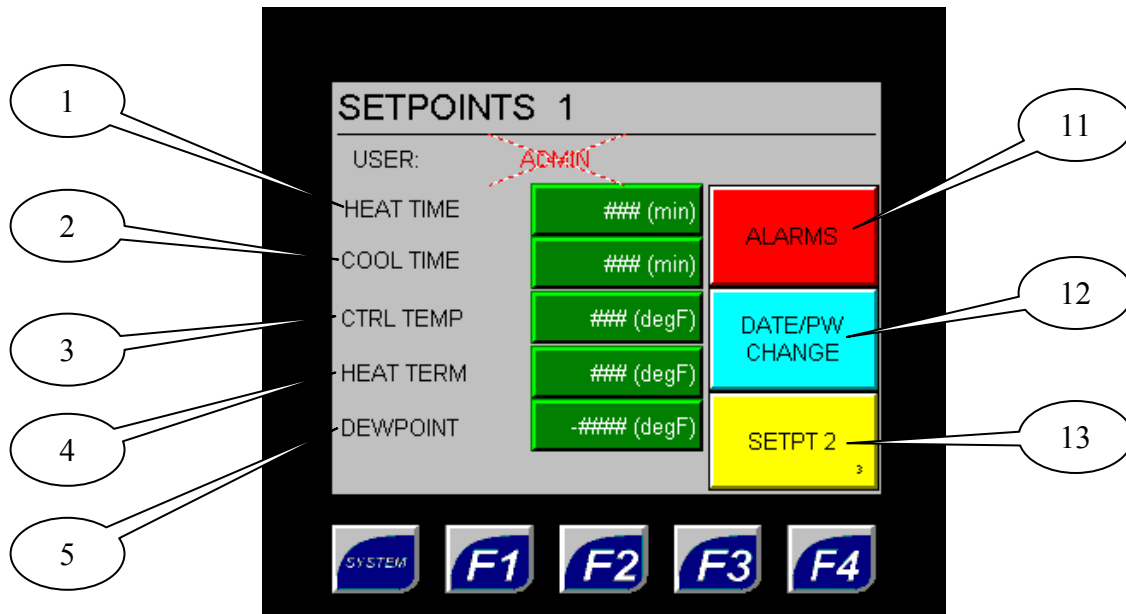
F. Miscellaneous screen



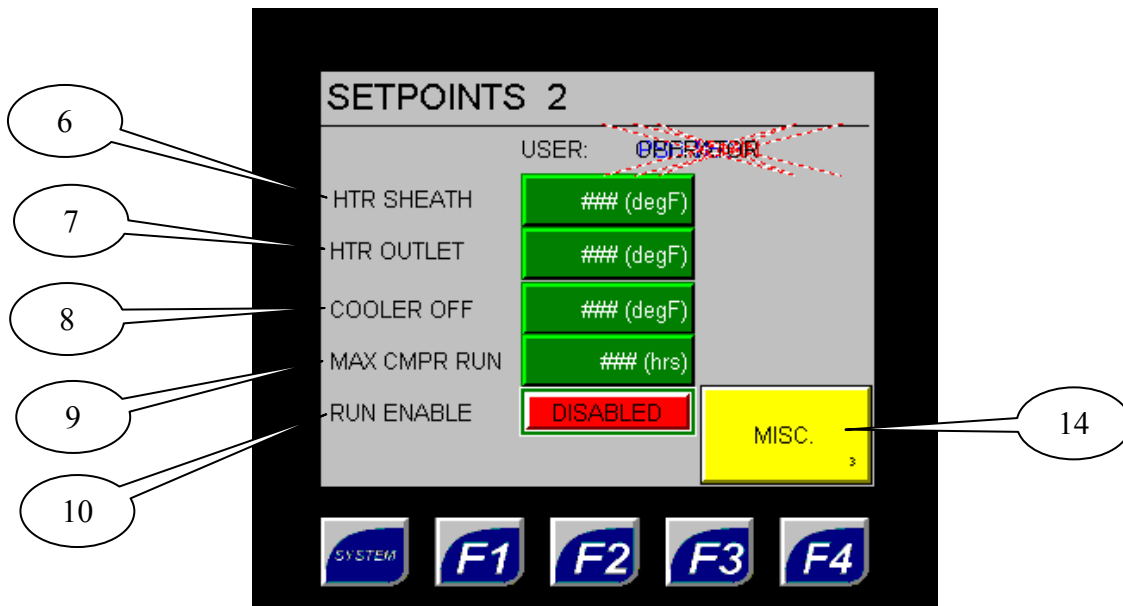
This screen enables changes to regeneration cycle and regeneration temperature. Screen is password protected and requires login as “admin” before values become visible. Login is done at Main screen.

Item	Object	Description
1	Comm status pushbutton	When pressed, the communication status screen becomes visible.
2	I/O status pushbutton	When pressed, PLC inputs, outputs, and analog values are shown.
3	Log out pushbutton	When pressed, user level is changed from “ADMIN” to “OPERATOR”.
4	Setpoint pushbutton	When pressed, the setpoint screen becomes visible and if “ADMIN” user level is active changes are permitted.
5	Event History pushbutton	When pressed, the event history screen becomes visible. This is accessed when “ADMIN” user level is activated.
6	Main Menu pushbutton	Returns to main menu screen.

G. Setpoint screens



This screen enables changes to regeneration cycle and regeneration temperature. Screen is password protected and requires login as “admin” before values become visible. Login is done at Main screen.



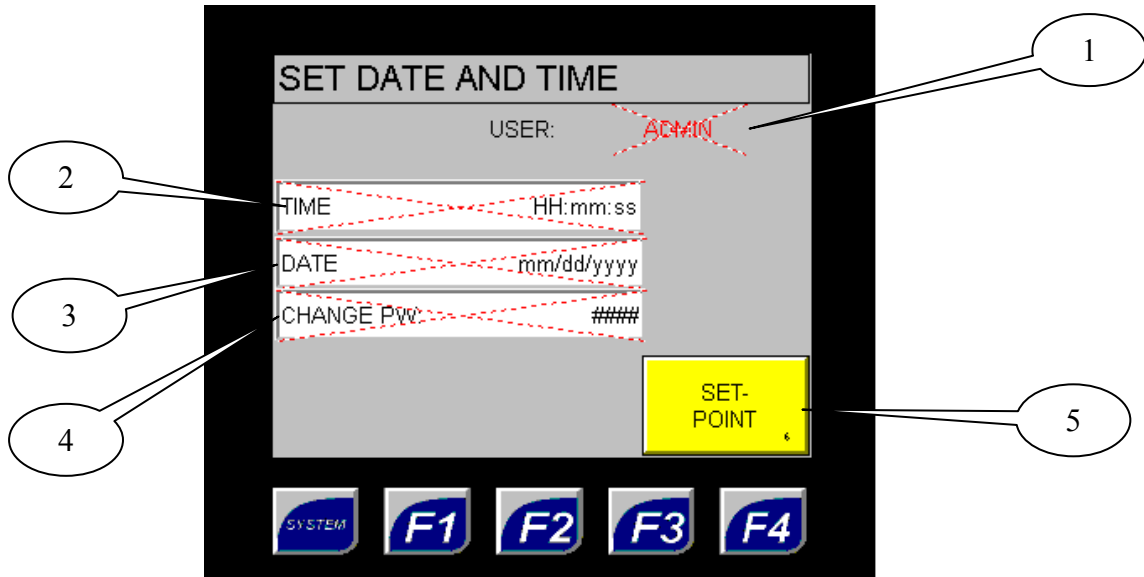
This screen is a continuation of previous screen to enable changes to regeneration cycle and interface with compressor.

Item	Object	Description
1	Heat time numeric entry	Regeneration heat time can be adjusted to handle performance issues. Touching screen where value is shown opens keypad to enable setpoint change. Entry is limited to maximum of 600 minutes

Item	Object	Description
2	Cool time numeric entry	Regeneration cool time can be adjusted to handle temperature issues that may occur at cooldown. Touching screen where value is shown opens keypad to enable setpoint change. Entry is limited to maximum of 600 minutes
3	Heater control temperature numeric entry	Regeneration heater output can be changed using this parameter. Touching screen where value is shown opens keypad to enable setpoint change. Entry is limited to maximum of 450°F and a minimum of 0°F.
4	Heat termination temperature numeric entry	Regeneration heat termination temperature can be changed using this parameter. Touching screen where value is shown opens keypad to enable setpoint change. Entry is limited to maximum of 350°F and a minimum of 100°F.
5	High dewpoint temperature numeric entry	Outlet moisture alarm can be changed using this parameter. Touching screen where value is shown opens keypad to enable setpoint change. Entry is limited to maximum of -40°F and a minimum of -100°F.
6	Heater sheath temperature numeric entry	Regeneration heater protection limit can be adjusted to simulate alarm. Touching screen where value is shown opens keypad to enable setpoint change. Entry is limited to maximum of 800°F.
7	Heater outlet temperature numeric entry	Regeneration heater max. output can be adjusted to simulate alarm. Touching screen where value is shown opens keypad to enable setpoint change. Entry is limited to maximum of 500°F.
8	Cooler OFF temperature numeric entry	Regeneration cooler OFF can be changed to prevent freeze up in low ambient temperatures. Touching screen where value is shown opens keypad to enable setpoint change. Entry is limited to maximum of 75°F and a minimum of 40°F.
9	Maximum compressor run time numeric entry	Compressor run time is setpoint is used to trigger regeneration message. Touching screen where value is shown opens keypad to enable setpoint change. Entry is limited to maximum of 150 hours.
10	Compressor run time enable pushbutton	Compressor run time can be enabled or disabled using this button. Pushbutton toggles operation of feature.
11	Alarms pushbutton	When pressed, main alarm screen showing current status becomes visible. If flashing, then an alarm is active.

Item	Object	Description
12	Date/Time and Password chg pushbutton	Changes screen to enable administrator to change PLC date and time. Password change is also done thru this screen.
13	Setpt 2 pushbutton	Selects the second setpoint screen.
14	Misc pushbutton	Return to Miscellaneous screen menu.

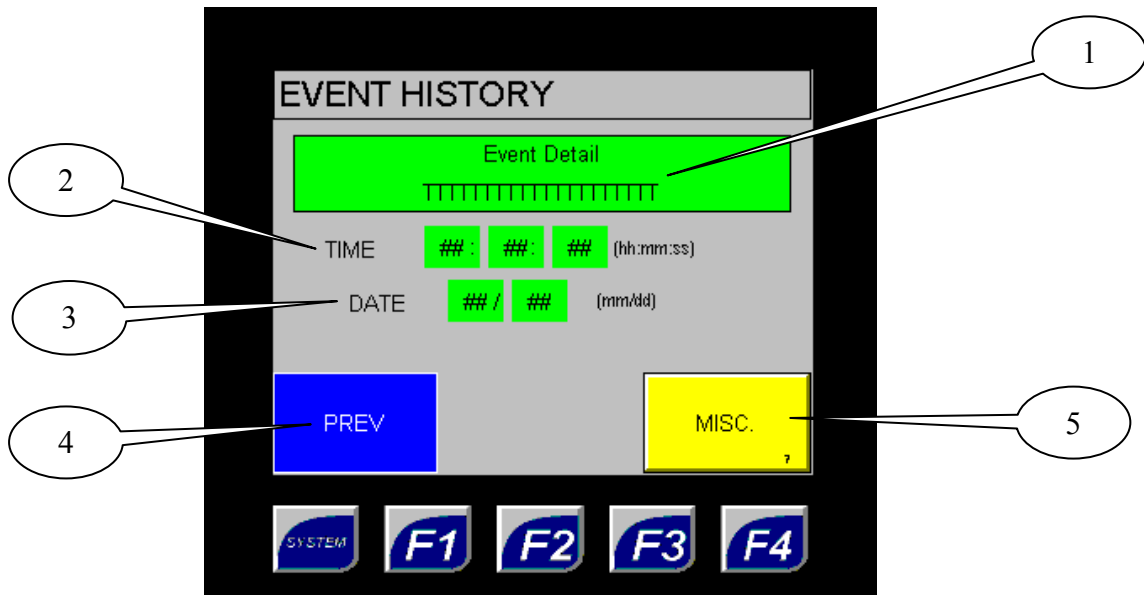
H. Date/Time/Password screen



This screen allows administrator to change date, time, and password. Screen is accessed only when user is “ADMIN”.

Item	Object	Description
1	User login indicator	This shows current user that is logged in.
2	Time adjust numeric entry	Touching screen in area of time opens numeric keypad with arrow keys to change hour, minutes, and seconds.
3	Date adjust numeric entry	Touching screen in area of date opens numeric keypad with arrow keys to change month, day, and year.
4	Password change numeric entry	Touching screen in this area opens numeric keypad with “ENT” and “ESC” keys.
5	Setpoint pushbutton	Returns to setpoint change screen.

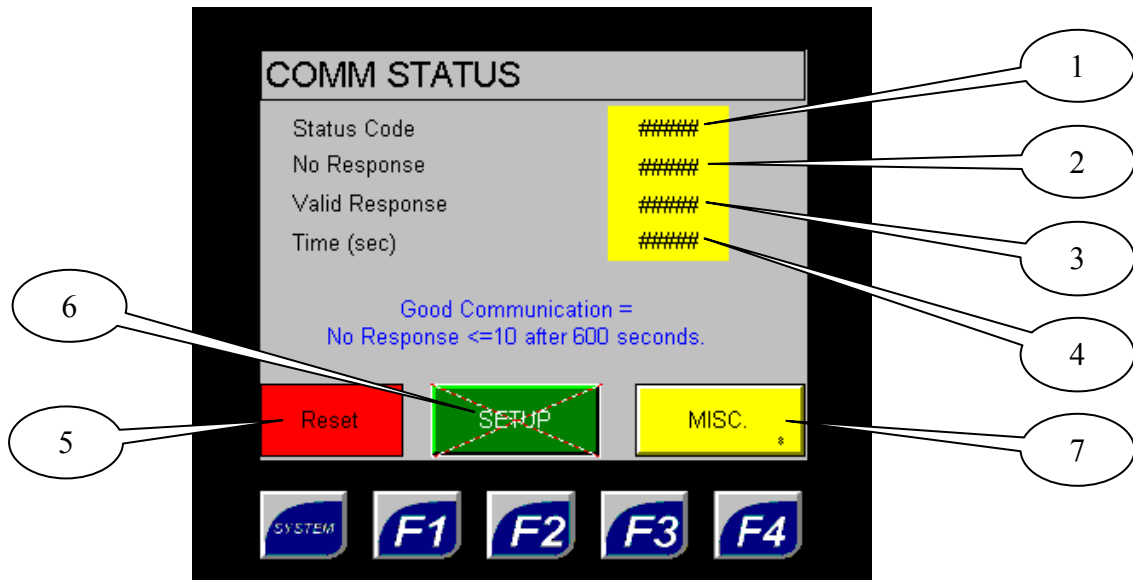
I. Event History screen



This screen enables administrator to view history of operator actions, system alarms, and any setpoint changes. Up to 100 Events are stored with the oldest event being removed. PREV button steps through events from latest to oldest. When screen becomes visible, the latest event is shown. Screen is accessed only when user is "ADMIN".

Item	Object	Description
1	Event detail numeric	This shows event that occurred. An event can be a system alarm, operator action, and any setpoint change.
2	Time numeric	Actual time is recorded when event was generated. Display is in hours:minutes:seconds.
3	Date numeric	Actual date is recorded when event was generated. Display is in month/day.
4	Previous pushbutton	When button is pressed, the next earlier event is shown.
5	Misc. pushbutton	Returns to Miscellaneous screen menu.

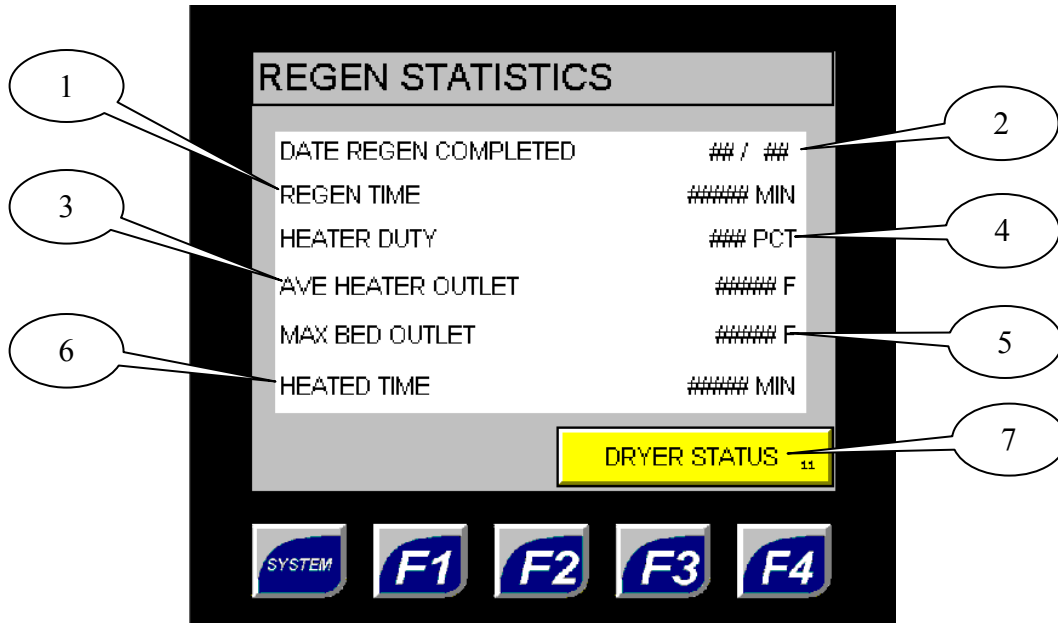
J. Communication Status screen



This screen enables administrator to view communication between PLC and thermocouple module. Should a communication error occur, this screen provides some troubleshooting aids to determine problem. A timer quantifies how well communication is occurring.

Item	Object	Description
1	Status code numeric	This shows code that represents error that is generated. A code of zero signifies good communication.
2	No response numeric	This shows number of times that module did not respond to PLC communication. Status code will change when count increments.
3	Valid response numeric	This shows the number of times that the module responded correctly.
4	Time numeric	This increments each second after "RESET" button is pressed. Used for monitoring communication for period of time.
5	Reset pushbutton	This button resets above objects 2 through 4 so quality of communication can established.
6	Setup pushbutton	Sets up communication between PLC and thermocouple module. Unauthorized changes will impact communications and render unit inoperable.
7	Misc. pushbutton	Returns to Miscellaneous screen menu.

K. Regen Statistics Screen

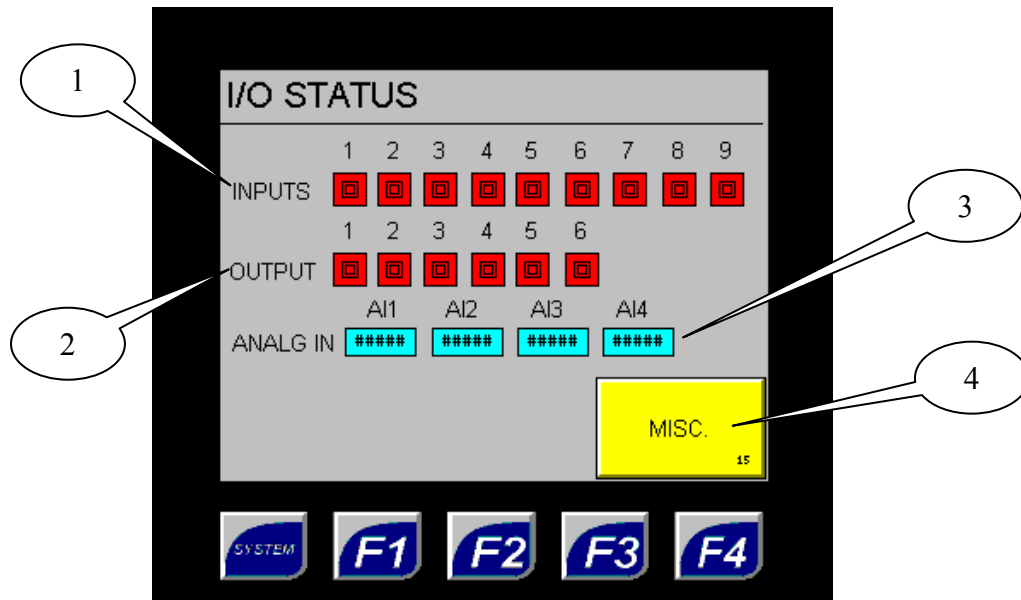


This screen provides overall general information on quality of regeneration. During regeneration process, information is accumulated for reference later. Detailed information on each parameter is listed below.

Item	Object	Description
1	Regen Time Indicator	Shows overall cycle time to regenerate vessel. Used to determine if cycle was interrupted or incomplete.
2	Regen Complete Date Indicator	Shows the last completed regeneration date. Date shown is when regeneration completes without operator intervention.
3	Heater Duty Indicator	Shows output of heater over entire “heating” portion of cycle. Value shown is in a percentage of “ON” time – 0% being completely OFF, 100% being completely ON. Generally, a value around 60-80% is acceptable and indicates a good amount of heat has been used to regenerate vessel.
4	Ave Heater Outlet Indicator	Show average temperature of heater. A value that is within 50°F of setpoint (usually 425°F) will mean that sufficient heat has been present to ensure desiccant has been fully regenerated. Low temperature may indicate cycle was interrupted, or problem with excessive regeneration flow.
5	Max Bed Temperature Indicator	Gas temperature exiting desiccant bed is monitored by TE-2. This Indicator displays the highest temperature that occurred during the regeneration cycle. The higher the temperature, the more moisture is removed from descant bed.

Item	Object	Description
6	Heated Time Indicator	Shows amount of time that vessel was heated during regeneration cycle. Standard time is 180 minutes. A value below this may indicate unit heating was shortened by operator or, if equipped with bed thermocouple, temperature rose quickly because of small amount of moisture accumulated during on-stream time.
7	Dryer Status Pushbutton	When pressed, dryer status screen appears to show temperatures of dryer.

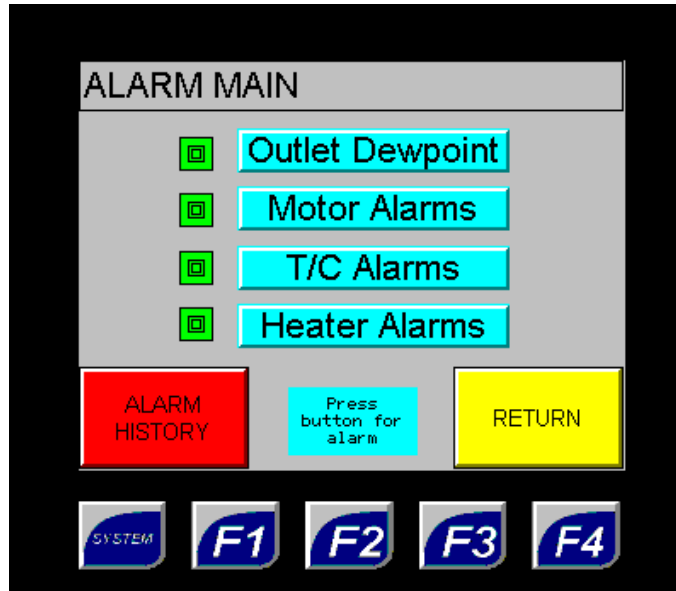
L. Input/Output Maintenance screen



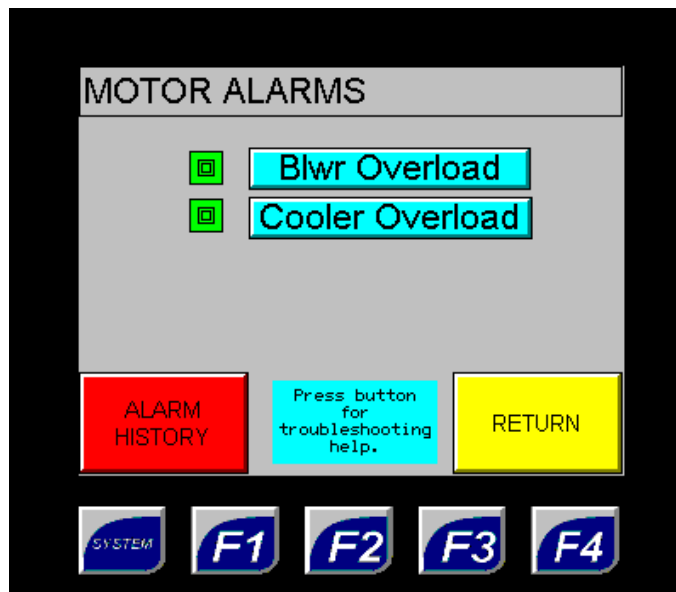
This screen is used for troubleshooting inputs and outputs. Unless technician is familiar with wiring, it is strongly recommended to refer to electrical schematic for which I/O point is connected to field device. Analog values generally should be fluctuating and not at limits.

Item	Object	Description
1	Input indicators	When indicator is GREEN, then voltage is applied to PLC input. A RED indicator means voltage is absent.
2	Output indicators	When indicator is GREEN, then output is turned ON and connected load is energized. A RED indicator means output is OFF and connected load is de-energized.
3	Analog input numeric	Numerical value between 0 and 65,535 will be present. Scaling of voltage/current level will place value between defined limits. This value is raw and lacks scaling to engineering units.
4	Misc pushbutton	Returns to Miscellaneous screen menu.

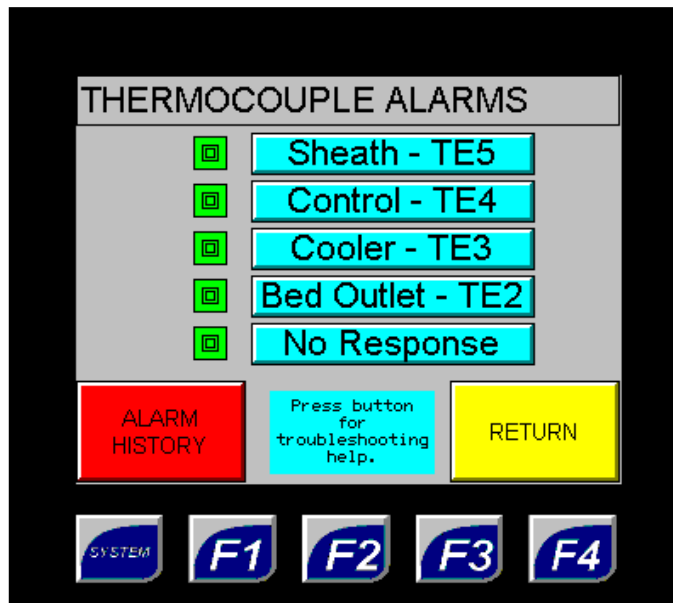
M. Alarm indication screens



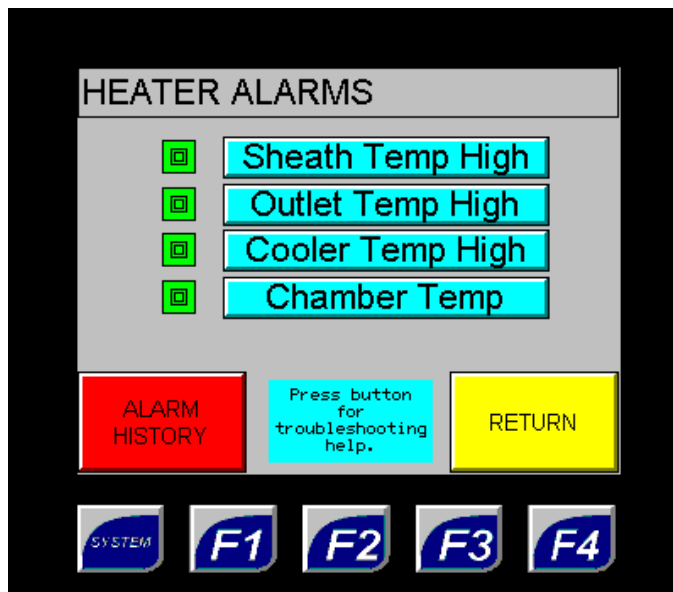
This screen is the main alarm screen that becomes visible when “ALARMS” button is pressed. The alarms are split up into 3 additional screens for ease of organization. The indicator to left of legend will flash and pressing legend button will make visible the screen. A troubleshooting screen for each alarm is accessed by pressing legend except for buttons to select additional screens. “ALARM HISTORY” button will show alarms that have occurred since power cycle.



This screen shows motor overload status. A flashing red indicator shows operator which alarm has occurred. Motor overloads will reset automatically after 2 min. Pressing F3 then, will clear alarm. “RETURN” button will close screen and previous screen will become visible. A troubleshooting screen for each alarm is accessed by pressing legend. “ALARM HISTORY” button will show alarms that have occurred since power cycle.



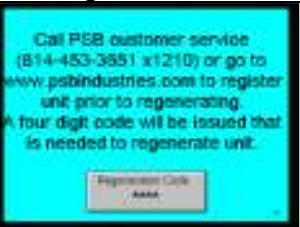


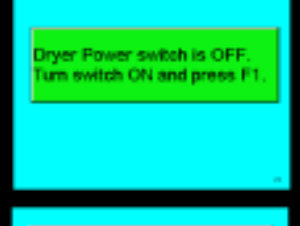


This screen shows thermocouple status and whether thermocouple is responding appropriately. A flashing red indicator shows operator which thermocouple has failed. Pressing F3 will clear alarm. “RETURN” button will close screen and previous screen will become visible. A troubleshooting screen for each alarm is accessed by pressing legend. “ALARM HISTORY” button will show alarms that have occurred since power cycle.











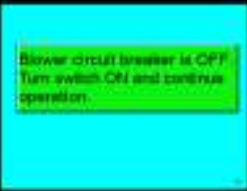

This screen shows heater/cooler temperature alarms. A flashing red indicator shows operator which alarm has occurred. Pressing F3 will clear alarm except for “Chamber Temp” alarm which requires cycling Dryer Power switch . “RETURN” button will close screen and previous screen will become visible. A troubleshooting screen for each alarm is accessed by pressing legend. “ALARM HISTORY” button will show alarms that have occurred since power cycle.

V. OPERATOR TERMINAL MESSAGES

The following messages will be displayed under circumstances. Three types of messages are used. 1) alarm messages, 2) troubleshooting messages, and 3) notification messages.

Message	Purpose	Visibility Trigger	Clear condition
	Remind operator or owner to register dryer. 4-digit code will be given at that time.	First Power-up	After code has been entered.
	Notification that correct regen code has been entered.	Correct regen code	5 second time delay
	Notification to operator to enter regeneration code as first step in regeneration start process.	Dryer Power switch ON and F1 button pressed.	After Code has been entered, or 5 seconds of inactivity.
	Notification to operator that Dryer Power switch is in OFF position.	Dryer Power switch OFF and F1 button pressed.	5 second time delay.
	Remind operator to turn off Dryer Power switch and drain condensate.	Regeneration cycle completed.	“Return” button pressed.
	Prompt operator to lower pressure so that heater outlet temperature will rise.	Heater outlet temp reached setpoint but has fallen below 370°F.	“Return” button pressed.

Message	Purpose	Visibility Trigger	Clear condition
	Prompt operator to verify moisture reading with compressor running and/or regenerate dryer.	Outlet moisture level has triggered alarm.	“Return” button pressed or F3 button pressed or other action.
	Notification that regeneration cycle has been advanced to cooling.	F2 button pressed and held for 5 seconds when regen is running.	5 second time delay or other action.
	Notification that cycle has been reset to beginning.	F2 button pressed and held for 5 seconds when regen is stopped.	5 second time delay or other action.
	Notification of dryer regeneration cycle has been stopped (paused). Remaining amount of 600 second limit is displayed.	Pressing F1 to Pause regen sequence or each minute of ten minute limit or F1 button to restart.	Remains until restarted or “Return” button pressed.
	Maintenance activity needed to check moisture analyzer for operation.	Every 30 days or 2 days later if “Remind later” button is pressed.	Login ADMIN to reset or “Remind later” button pressed.
	Maintenance activity needed to place order with PSB customer service for probe recalibration.	Every 180 days or 2 days later if “Remind later” button is pressed.	Login ADMIN to reset or “Remind later” button pressed.
	Prompt to operator that cooler OFF temperature setpoint was temporarily raised to 50°F.	TE3 temperature at or below 34°F at regeneration start.	F3 button pressed or “Return” button pressed.
	Maintenance activity needed to check and/or replace filter elements.	Every 180 days or 2 days later if “Remind later” button is pressed.	Login ADMIN to reset or “Remind later” button pressed.

Message	Purpose	Visibility Trigger	Clear condition
	Prompt to operator that blower circuit breaker is OFF.	Pressing F1 to start regeneration	5 second time delay or other action.
	Prompt to operator that maintenance reminder for filters, and moisture analyzer has been reset.	“Login to reset” button pressed and proper ADMIN code has been entered.	5 second time delay or other action.
	Compressor run time has exceeded preset if enabled.	Time limit reached or “Return” button pressed but no regen cycle initiated.	“Return” button pressed delays message for 6 compressor run hours.
	Enabled operator to select which type of message to review.	Pressing F4 key	15 second time delay or message type button pressed.
	Indicates to operator that end of message history has been reached.	Pressing F4 key when last message in history is reached.	5 second time delay or other action.
	Provides operator feedback on F1 key press to start regeneration cycle.	Regen code has been entered.	Regeneration cycle started or 5 second time delay.

VI. STARTUP/SHUTDOWN INSTRUCTIONS

Refer to Flow Diagram in Section VII.



IMPORTANT! Sudden or rapid changes of pressure may damage dryer blower. Use care in operating valves. Changes in pressure should not exceed 30 PSIG per minute.

STARTUP INSTRUCTIONS:

A. Leak Check

Open valves V2, V3, V4, and V5 for leak check – all other valves to be closed. Slowly open inlet valve V1 to pressurize the dryer. Leak check the dryer assembly with soap and water mixture checking for bubbles and repair any leaks resulting from the shipping.

B. Set Valves

Close valves V1, V3, V4, V6, V7, V8, V9, V11, V12, V13, and any instrument valves which open to atmosphere.

Open valves V2, V5, and V10.

C. Purge System

This procedure should be used whenever piping has been opened to atmosphere. Repairing leaks, replacing filters or desiccant are maintenance operations where the dryer assembly must be purged to remove air (that contains oxygen). Natural gas tends to be lighter than air and will accumulate towards the top of closed volumes. Purge procedure removes trapped air from various sections of dryer – pre-filter, dryer vessel & after-filter, then regeneration loop.

1. Open valve V8 to purge the pre-filter housing “P” of air. Close when complete.
2. Open valve V9 to purge the dryer chamber and after-filter housing “A” of air. Close when complete.
3. Slowly open V3 then open valves V12, and V13 to purge the heater, blower housing, sump and separator. When complete open valve V4 and immediately close V3. This allows the cooler and the remaining piping to be purged of air. When complete, close valves V12 and V13. Once valves V12 and V13 have been closed, fully open valve V3.
4. Close valve V4 to isolate the regeneration system, and slowly open valve V6 to place the dryer into service.
5. **Initial Start-up Note:** New desiccant will initially adsorb mercaptans. To maintain odorant at the dryer exit, slightly open bypass valve V7 during initial operation.

D. Registration (first time only)

Registration is of paramount importance. PSB Industries desires to communicate with its customers/end users throughout the life of this product. A requirement to operate this unit is a 4 digit code that will be issued when registration process is complete. The information listed in Product Registration form located in section XVII will be asked for. Preferred information is end user/owner with contact person being maintenance or facility manager. Once information is obtained, then regen code will be issued. Code entry will be necessary for each regeneration. Store in accessible location with the intent to prevent unauthorized used of dryer.

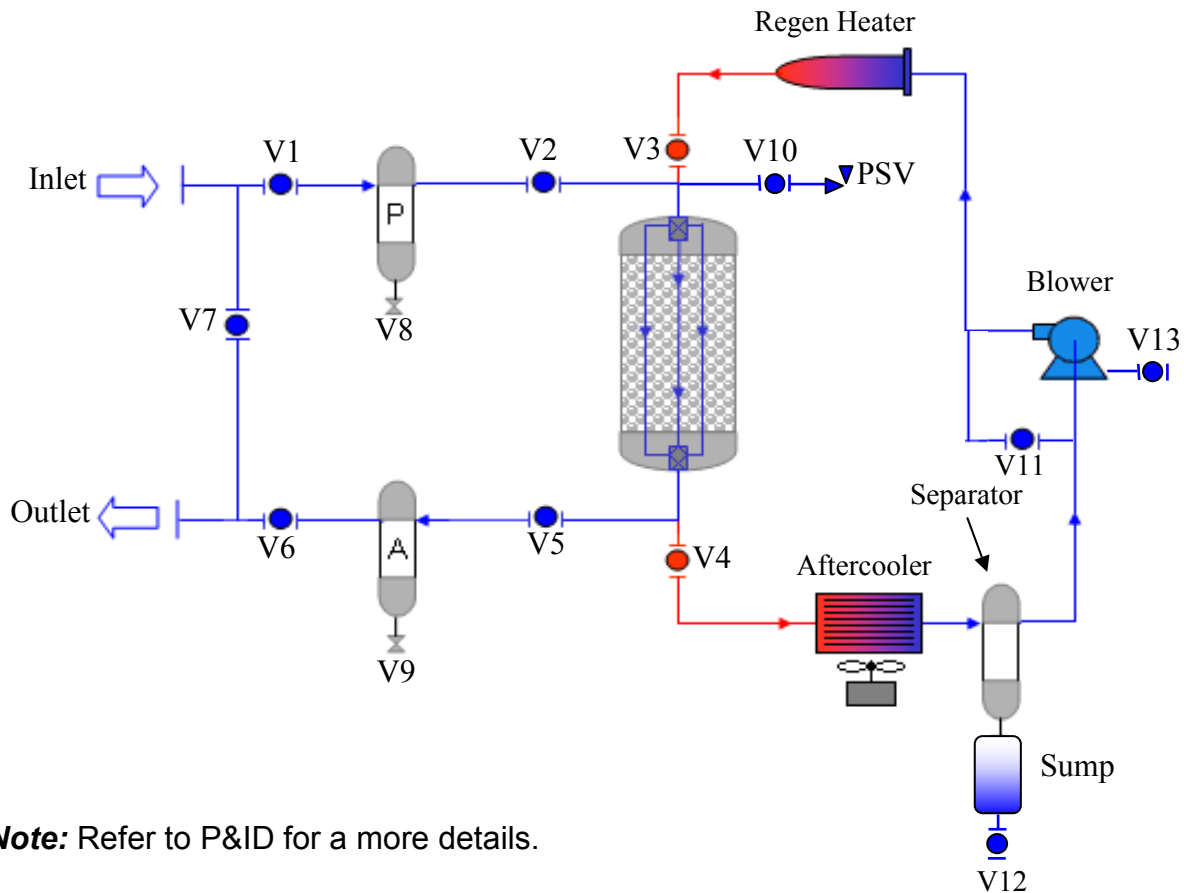
E. Regenerate

Vessel desiccant must be regenerated prior to use. Follow section X procedure.

SHUTDOWN INSTRUCTIONS:

1. Turn **DRYER POWER** switch **OFF**.
2. Close inlet and outlet valves V1 and V6. Open V7 to bypass dryer.
3. Open V12 to depressurize as needed.

VII. FLOW DIAGRAM



Note: Refer to P&ID for a more details.

VIII. COMPONENT DESCRIPTIONS

Desiccant dryers work on the principle of adsorption. Adsorption is the process of removing water VAPOR from the gas stream. All condensed entrained liquid water should be removed from the gas stream prior to reaching the dryer by suitable separators, traps, filters, and drains.

All desiccants are adversely affected by oil, oil aerosols, dirt, rust, scale or liquid water. Effective pre-filtration in conjunction with condensate drainage is a must for proper dew point depression and long desiccant life.

A. Process Components

1. Pre-filter

Inlet gas will pass through a cartridge type pre-filter to remove condensate and oil which could contaminate the desiccant bed. Two manual valves (V1& V2) allow the filter to be isolated and changed without depressurizing the system.

2. Dryer Vessel

This is a regenerative system in which the vessel removes moisture from the process stream.

3. After-filter

Dry gas, which contains desiccant dust, will pass through a cartridge type after-filter to remove the dust. Two manual valves (V5 & V6) allow the filter to be isolated and changed without depressurizing the system.

B. Regeneration Components

1. Blower

The regeneration blower circulates the gas through the vessel and entire regeneration circuit. Mounted inside of pressure housing, the explosion-proof motor is direct coupled to the blower.

2. Heater

The flanged immersion heater is designed to raise the regeneration gas temperature to 425°F prior to flowing into the saturated dryer bed. Heater outlet temperature is monitored by thermocouple at the outlet of the heater. The PLC controls the heater output through ON-OFF cycling of contactors.

3. Cooler

Hot regeneration gas leaving the dryer bed must be cooled prior to entering the separator. The hot gas passes through the air-cooled heat exchanger. A motor driven fan draws air across the fins removing heat and condensing moisture.

4. Separator & Sump Tank

The separator separates moisture condensate from the gas stream. A coalescing element ensures that fine mist is removed from the gas stream. Condensate drains to the sump tank which MUST be drained after each regeneration.

5. Blower Bypass Valve

This valve is used to maximize the regeneration efficiency. System pressure changes may cause heater temperatures to fall below ideal setpoint. Opening valve increases temperature of heater. Conversely, closing valve during cooling will maximize cooling effectiveness. The valve allows operator to maximize regeneration temperature balance.

IX. DESICCANT REPLACEMENT

When the exit moisture content has exceeded customer requirement, but yet correct dryer operation and regeneration has been verified the desiccant may need to be replaced with fresh material. NOTE: Use only PSB Specified desiccant.



CAUTION: Desiccant dust is considered a nuisance dust. Proper precautions should be taken when handling. Refer to “Material Safety Data Sheet”.

Procedure:

1. Remove pressure and power from dryer.
2. Open drain port on bottom of tank to remove desiccant.
3. Catch desiccant in suitable container. When empty, close drain port.
4. Open fill port on top of vessel to allow filling. Refer to parts list (section XIV) for part number and amount.
5. Insert a long, flexible sock (plastic or cloth). With the sock touching vessel bottom, chemical may be poured into the sock while slowly retracting it to just above the fill level. This method will minimize dusting and potential breakage of desiccant from free fall onto the vessel bed screen.
6. Some settling may be required to fit specified amount in tank. Fill to a maximum height of the weld seam of vessel to prevent excessive pressure drop. One tank size may be used for multiple models, do not be concerned if tank is not full
7. Consult Material Safety Data Sheet and all applicable regulations for disposal of desiccant. Disposal of desiccant contaminated with oil or other substances may require different procedures than desiccant replaced strictly due to aging.
8. Follow sequence of operation (section VI) to place dryer back in service.
9. New desiccant will initially adsorb mercaptans. To maintain odorant at the dryer exit, slightly open bypass valve V7 during initial operation or open the optional mercaptan bypass valve.

X. REGENERATION

Regeneration must be performed when the dryer is no longer able to produce the dew point specified. Dryer pressure MUST be at 10 PSIG. For best results, regeneration should be performed during the coolest part of the day. Condensate sump tank must be drained prior to start.



WARNING: Failure to reduce pressure to 10 PSIG may result in blower damage or poor performance. Sudden or rapid changes of pressure may damage dryer blower. Use care in operating valves. Changes in pressure should not exceed 30 PSIG per minute.

Procedure - Refer to Flow Diagram in section VII.

1. Close dryer inlet & outlet isolation valves, valve nos. V1 and V6.
Note: Bypass valve V7 may be opened if the process flow is required during regeneration. Moisture will not be removed while bypass valve is open.
2. Close filter isolation valves, valve nos. V2 and V5.
3. Open regeneration loop isolation valves V3 & V4. Verify valve V11 is closed.
4. Reduce pressure to 10 PSIG by slowly opening valve V12 (located on the separator sump tank). Shut valve V12 when it reaches 10 PSIG. If operating pressure is lower than required regeneration pressure, open valve (supplied by others) from high pressure source to regeneration loop.



CAUTION: make sure the drain is vented to a safe location.

5. Turn “**DRYER POWER**” switch **ON**.
6. To start regeneration, press F3 key to clear alarms. Press F1 key and enter 4 digit regen code. Then press and hold F1 key on the operator display terminal. When dryer starts, verify that the blower is operating; cooler fan motor is in operation, i.e. drawing air across the cooling fins; and regeneration heater is energized by observing a gradual temperature rise on thermometer TI-4.
7. The approximate regeneration heating time is 6 hours. The correct regeneration inlet temperature to the desiccant chamber is between 375°F to 425°F. The desired regeneration outlet temperature is approx. 200°F to 300°F. The heating time may require extension based on water load and ambient conditions to achieve these desired temperatures. To minimize energy usage and thermal aging of desiccant, a thermocouple (TE-2) located on vessel outlet is used to sense when desiccant moisture adsorption is below design. Setpoint can be optimized based on actual operating conditions but is recommended @ 250°F.
8. The approximate cooling time is 4 hours. At the end of cooling, TI-2 temperatures in the range of 100°F to 120°F are acceptable.
9. When regeneration is complete close valves V3 and V4. Drain liquid from the sump tank by opening valve V12. Close valve V12 when all liquid has been drained. Verify bypass valve V7 is closed. Open valves V1, V2 and V5 slowly waiting until the line reaches operating pressure before opening the next valve in the sequence. To return the dryer into service slowly open valve V6.



IMPORTANT: During the heating cycle and approximately one-hour into the cooling cycle liquid condensate will form in the separator and be stored in the separator sump tank. Be sure that flexible drain hose “free drains” (no traps) to sump tank from separator.

10. Turn “**DRYER POWER**” switch **OFF**.

XI. ALARMS

A. Regeneration Heater Sheath Overtemperature

This alarm protects the heater from damaging high element temperatures due to low or blocked flow.

Input: Temperature from TE-5

Setpoint: 800 F;

Action: Turn OFF Heater; alarm light (2LT) steady ON; Stop Regeneration operation; Operator reset required.

B. Regeneration Heater Outlet Temperature High

This detects a failure of heater control devices that may cause heater to produce excessive regeneration gas temperatures.

Input: Temperature from TE-4

Setpoint: 500 F;

Action: Turn OFF Blower/Heater; alarm light (2LT) ON; Stop Regeneration operation; Operator reset required.

C. Cooler Outlet Temperature High

This alarm prevents damage to blower due to high inlet blower temperature.

Input: Temperature from TE-3

Setpoint: 120 F;

Action: Turn OFF Heater; alarm light (2LT) ON; Stop Regeneration operation; Operator reset required.

D. Blower Overload

This detects excessive blower motor amperage. Amperage is converted to heat that starter overload relay can sense and open control circuit to blower starter.

Input: Contact opening from M2-OL

Setpoint: Fixed;

Action: Turn Off Blower/Heater; alarm light (2LT) ON; Stop Regeneration operation; Operator reset required.

E. Cooler Overload

This detects excessive cooler fan motor amperage. Amperage is converted to heat that starter overload relay can sense and open control circuit to cooler fan motor starter.

Input: Contact opening from M3-OL

Setpoint: Fixed;

Action: Turn OFF Blower/Heater; alarm light (2LT) ON; Stop Regeneration operation; Operator reset required.

F. Heater Chamber Shutdown

A thermocouple (TE-6) is physically attached to heater housing. When housing temperature rises above a fixed setpoint, the heater contactor opens. Blower continues to run to cool housing down. This is a hard wired safety and PLC monitors operation.

Input: TSHH temperature switch

Setpoint: 500°F

Action: Alarm light (2LT) ON; Heater turns OFF. Dryer operation continues; Turning off Dryer Power switch resets alarm.

G. Thermocouple Failure

The PLC thermocouple module detects when thermocouple has opened. Alarm stops operation until condition is corrected. A “No Response” alarm is activated when TE4 or TE5 does not show an increase in temperature from ambient.

Input: Thermocouple module Open status bits

Setpoint: Fixed;

Action: Turn OFF Blower/Heater; alarm light (2LT) ON; Stop Regeneration operation; Operator reset required.

H. RS-485 Communication Problem

Communication to thermocouple module is via RS-485. Failure of link will result in dryer operating without current temperature data and loss of control.

Input: PLC communication port status bits

Setpoint: Fixed;

Action: Turn OFF Blower/Heater; alarm light (2LT) ON; Stop Regeneration operation; Operator reset required.

I. Dewpoint

Dryer outlet moisture rising above setpoint triggers alarm. This alarm is informational only.

Input: Temperature from ME1

Setpoint: -55°F

Action: Alarm light (2LT) ON; Dryer operation continues

XII. MAINTENANCE PROGRAM

- Daily – Check outlet dewpoint when gas is flowing for reading below -40°F. Make sure that V6 has been closed slightly to ensure proper gas flow over sensor.
- Weekly - Drain pre-filter, blower housing and sump.
- Weekly - Check differential pressure across pre-filter and after-filter elements. Replace if required when gauge is approaching RED zone or 3-5 PSID.
- Monthly - Check and maintain operating conditions; pressure, flow, temperature within the design parameters of the dryer.
- Monthly - Verify dew point (if instrument available). Remove sensor from sample cell and verify instrument responds to ambient moisture condition.
- Six Months - Recalibrate/check span of moisture analyzer. Refer to Xentaur manual for details.
- Six Months - Replace pre-filter, after filter and separator elements.
- 1 yr/250 hrs - Check oil level using blower maintenance procedure shown below.
- 2 years - Replace or regenerate desiccant if exit moisture exceeds requirement.
- 5 yr/1000 hrs - Change oil in blower.

Blower Maintenance Procedure

1. Remove power from unit; Isolate regeneration loop from process and depressurize.
2. Remove studs and nuts from flange assembly on blower housing
3. Remove blower housing hold-down bolt and pull housing until blower is accessible.
4. Oil level in the oil sumps at each end of the blower should be at the middle of the sight gauges. Initial factory fill of oil is with Roots synthetic lubricating oil ISO-VG-220. Ambient temperature 32° to 90°F.
5. Reinstall blower assembly in reverse order. Use new spiral wound type gasket when bolting flange up to housing to prevent leaks.
6. Perform leak check and purge procedures before placing into service.

Filter Element Replacement Procedure

1. Isolate the filter by closing block valves on either side of filter.
2. Depressurize the filter housing slowly using drain valve at filter bottom.
3. Unscrew housing or unbolt top access closure and replace filter element.
4. Reinstall housing and purge the housing of air by opening one block valve and drain valve at filter bottom.

DDP Monthly Maintenance Procedure

1. Isolate sensor sample cell by closing valves on either side.
2. Disconnect electrical connector and remove from sample cell.
3. Reconnect electrical connector and monitor moisture reading. Reading should rise to near ambient dewpoint within 10 minutes.
4. Reinstall sensor into sample cell and attach electrical connector to sensor.
5. Open sample cell valves. It will take time for moisture level to return to previous reading.

Cold Weather Package Option (Heat Tracing and PLC Panel Heater) or Heat Tracing Option

Dryer may be equipped with options to keep sump tank condensate and PLC components from damage by ambient temperatures below +32°F. It is imperative that control power be applied at all times when cold conditions are present.

Sump tank has an indicator light that should be illuminated when power is present. Electrical heat tracing is protected by a ground fault equipment protector (mounted in High voltage panel) to minimize electrical shock and equipment damage. An ambient temperature sensor prevents operation above 55°F degree operation.

A low voltage panel heater is mounted vertically along the left side interior of panel and contains a hermetic thermostatic controlled switch to keep internal components warm. A guard prevents accidental contact with heater surface. Care should be used when working in proximity of heater.

XIII. TROUBLESHOOTING

Symptom	Probable Cause	Remedy
No or Low heater outlet temperature	Fuses blown	Test and replace
	Contactors not energized	Check voltage on coil. Replace as required
	Regeneration Cycle in cooling	Reset control by pressing and hold for 5 seconds "ALARM RESET" pushbutton. Then press "REGEN START".
	Heater failure	Check resistance and replace if open.
	Too much flow	Open blower bypass valve. adjust as necessary to control flow.
Blower Overload alarm	Overloads tripped	Reset
	Contactors not energized	Check voltage on coil. Replace as required
	Blower mechanical problem	Depressurize and remove blower housing. Check blower freely rotates
Heater outlet temperature high alarm	Regeneration pressure low	Raise to 10-15 PSIG
	Contactors malfunction	Check for welded together contacts
	Thermocouple problem	Test and replace as needed.
	Blower failure	Refer to symptom "Blower overload alarm"

XIII. TROUBLESHOOTING – cont'd

Symptom	Probable Cause	Remedy
Cooler Overload alarm	Overloads tripped	Reset
	Contactors not energized	Check voltage on coil. Replace as required
	Motor failure	Check windings and replace as needed.
Excessive process pressure drop	Excessive process flow	Reduce to design
	Valves not in correct position for regeneration	Open valves "V3" and "V4".
	Filters plugged	Replace filter elements
Poor dew point	Dew point sensor isolated	Open ¼" valves to flow gas across sensor.
	No flow across sensor for long period of time	Pass flow through dryer. Then monitor. Slightly close V-6 to create flow across sensor.
	Excessive inlet moisture	Regenerate unit with greater frequency or reduce moisture input or flow.
	Regeneration problem	Restart regeneration and monitor heater output and cooler temperature.
Cooler Outlet Temperature High Alarm	Cooler fan not running	Refer to symptom "Cooler overload alarm"
	Ambient temperature high	Regenerate when air temperature is < 100°F
	After-cooler dirty	Clean dirt and debris from fins.
	Thermocouple failure	Test and replace as needed.
Heater Sheath Over Temperature Alarm	Blower failure	Refer to symptom "Blower overload alarm"
	Flow blocked	Open valve "V3" to increase flow.
	Heater thermocouple failure	Test and replace as needed.
	Low regen flow	Close blower bypass
Heater Chamber Alarm	Heater contactor mechanical problem	Verify contactor operation and replace as needed.
	Valve closed	Verify that V3 and V4 valves are open during regeneration.
	Blower problem	Blower mechanical issue (coupling or blower internal binding)
	Blower fuse blown	Check and replace as necessary
	Low regen flow	Close blower bypass
Thermocouple Failure Alarm	Wiring problem	Check for loose connections
	Thermocouple bad	Remove and replace
	PLC problem	Check power to thermocouple
		Check thermocouple module

XIII. TROUBLESHOOTING – cont'd

Symptom	Probable Cause	Remedy
TE4 or TE5 No response Alarm	T/C wiring problem	Check for shorted wiring
	Heater not producing heat	Determine if other alarms are active
		Verify that power is applied to heater
	Verify heater amperage is correct	
False positive detection	Reset alarm and monitor temperature for increase above 150°F in 5 minutes.	
RS-485 Communication problem Alarm	Cable unplugged	Reconnect and verify
	Termination resistor problem	Verify resistance is 120 ohms and connected between RX/TX at thermocouple module.
		Verify middle DIP switch on PLC is ON.
Baud rate problem	Verify that baud rate between PLC and thermocouple module is same.	

XIV. SPECIFICATIONS & DATA

A. GENERAL

INLET MOISTURE (Std.)	7.0 # /MMSCF
REGENERATION PRESSURE	10 PSIG
REGENERATION TIME (approx.)	10 HOURS
HEAT/COOL TIME (approx.)	6 HOURS/4 HOURS
ELECTRICAL LOAD	Refer to electrical schematic
AREA CLASSIFICATION	CL 1 DIV 2 GR D

B. DRYER VESSEL

DESIGN PRESSURE	Refer to dryer nameplate
DESIGN TEMPERATURE (Std.)	-20 TO 400°F
ASME CODE CONSTRUCTION	UW12c
NATIONAL BOARD REGISTRATION	YES
RELIEF VALVE	FIRE SIZED

C. HEATER

KW	Refer to electrical schematic
MATERIAL	INCOLOY
WATT DENSITY	<15 W/IN ²
CLASSIFICATION	CL 1 DIV 1 GR D

XV. PARTS LIST

Refer to Process & Instrument diagram (P&ID) for complete parts list. The parts list located on P&ID provides part numbers for replaceable parts. Contact factory service for specific internal parts on components not listed.

MODEL	DESICCANT LBS./TOWER
NG-SR-21-3	1500
NG-SR-21-4	1500
NG-SR-21-6	1500
NG-SR-30-4	2100
NG-SR-30-6	2100

Factory Service/Parts

When corresponding with the manufacturer regarding the dryer, always refer to model and serial number stamped on the nameplate located on the low voltage control panel. Call PSB customer service at (814) 453-3651.

XVI. PLC DATA ACCESS

The following list identifies the data points inside PLC that can be monitored by SCADA system. An Ethernet connection is configured with factory default IP address of 192.168.0.10. Follow PLC user manual to adjust IP address to suit installation. Configuration of SCADA should not allow access to any other PLC address than those listed below.

PLC Address	Data type	Description	Value Range
%R1100	Integer	Cooler Outlet Temperature	-346 to 2100°F
%R1101	Integer	Heater Outlet Temperature	-346 to 2100°F
%R1102	Integer	Heater Sheath Temperature	-346 to 2100°F
%R1103	Integer	Heat Termination Temp.	-346 to 2100°F
%R1104	Integer	Heating Time	0-600 minutes
%R1105	Integer	Cooling Time	0-600 minutes
%R1106	Integer	Spare	
%R1107	Integer	Dewpoint Analyzer	-148 to 68°F
%R1108.1	Binary	Blower Mtr. Overload Alarm	ON=Alarm
%R1108.2	Binary	Heater Sheath Overtemp Alarm	ON=Alarm
%R1108.3	Binary	Cooler Mtr. Overload Alarm	ON=Alarm
%R1108.4	Binary	Cooler Outlet Temp High Alarm	ON=Alarm
%R1108.5	Binary	Heater Outlet Temp High Alarm	ON=Alarm
%R1108.6	Binary	Thermocouple Open Alarm	ON=Alarm
%R1108.7	Binary	Dewpoint High Alarm	ON=Alarm
%R1108.8	Binary	Heater Chamber Alarm	ON=Alarm
%R1108.9	Binary	Spare	
%R1108.10	Binary	Spare	
%R1108.11	Binary	Spare	
%R1108.12	Binary	Spare	
%R1108.13	Binary	Regeneration Running	ON=Running
%R1108.14	Binary	Heating Done	ON=Heating Done
%R1108.15	Binary	Regeneration Done	ON=Regen Done
%R1108.16	Binary	Dryer Power On	ON=Power On

XVII. PRECOMMISSIONING CHECKLIST & PRODUCT REGISTRATION

Item Number	Action	Done	Notes
1	Check for shipping damage to dryer. Report any to the shipper.	<input type="checkbox"/>	
2	Remove all shipping braces and connection plugs/flange covers	<input type="checkbox"/>	
3	Install skid per General Arrangement drawing. Grout and level as needed.	<input type="checkbox"/>	
4	Connect process gas piping to tagged connection "INLET" and "OUTLET".	<input type="checkbox"/>	
5	Install relief valve on vessel (if applicable) or piping.	<input type="checkbox"/>	
6	Connect condensate drain piping to suitable drain that meets applicable codes	<input type="checkbox"/>	
7	Install moisture analyzer probe into sensor block and connect cable.	<input type="checkbox"/>	
8	Run conduit for power wiring to HV panel. Use proper conduit sealing as required by NEC code.	<input type="checkbox"/>	
9	Connect power source to panel terminal blocks as indicated on electrical schematic.	<input type="checkbox"/>	
10	Connect dryer alarm wiring to supervisory control system. Refer to electrical schematic for details.	<input type="checkbox"/>	
11	Equipment ground as required by NEC	<input type="checkbox"/>	
12	Check for tight wire connections at all terminal blocks	<input type="checkbox"/>	
13	Check for loose electrical components & fuses. Check all plug-in relays are securely seated in the relay sockets	<input type="checkbox"/>	
14	Using a meggar, check the heater insulation by connecting to load side of contactors. Reading should be greater than 50,000 ohms. Record readings below in chart for each heater.	<input type="checkbox"/>	
15	Before continuing with commissioning, read and understand information contained in Installation, Operation, and Maintenance manuals.	<input type="checkbox"/>	
16	Pressure check unit with nitrogen. Care must be taken in pressurizing and depressurizing unit slowly. Blower damage may result.	<input type="checkbox"/>	

Item Number	Action	Done	Notes
17	Padlock block valve at inlet of each relief valve (there may be multiple valves present) to OPEN position. <u>DANGER:</u> Failure to complete this action could result in personal injury or death.	<input type="checkbox"/>	
18	Open valves as indicated in section VI paragraph B "Set Valves".	<input type="checkbox"/>	
19	If not done, turn CB2 OFF to prevent blower from rotating incorrectly. Apply power to unit and verify correct phasing. Manually actuate M3 to verify cooler air flow is across motor.	<input type="checkbox"/>	
20	Turn CB2 to ON position after proper phasing is complete.	<input type="checkbox"/>	
21	Loosen bolts on heater support to allow thermal movement during operation. Bolts identified with tag that reads "CAUTION – LOOSEN SUPPORT BOLTS TO PREVENT EXCESSIVE THERMAL STRESS TO PIPING DURING NORMAL OPERATION".	<input type="checkbox"/>	
22	Verify desiccant is installed in vessel(s). Tag should be attached to vessel that reads "DESICCANT INSTALLED".	<input type="checkbox"/>	
23	Verify coalescing filter element is installed. Tag should be attached to filter housing that reads "FILTER ELEMENT INSTALLED"	<input type="checkbox"/>	
24	Verify particulate filter element is installed. Tag should be attached to filter housing that reads "FILTER ELEMENT INSTALLED"	<input type="checkbox"/>	
25	Install bolts in high voltage explosion-proof enclosure and tightly secure control enclosure catches.	<input type="checkbox"/>	
26	Verify Dryer Power Switch is in "OFF" position.	<input type="checkbox"/>	
27	Unit is ready for introduction of natural gas product. Perform required purging of air from system before startup.	<input type="checkbox"/>	
28	Contact PSB customer service to register unit and receive regeneration code.	<input type="checkbox"/>	

Electrical Heater Heater elements contain a material that adsorbs moisture. Mechanical safeguards are employed to prevent this from happening but damage can occur. The heater must be checked with an insulation resistance tester. All circuits must indicate a minimum resistance reading of 50,000 ohms between each circuit phase and ground. If any circuit does not meet this requirement, connect a low voltage source (120VAC) to a single circuit (if multiple circuit heater) for several hours and then recheck. This procedure may need to be repeated.

Ohm/ Meggar check of the Electric Heater. Record readings below.

Electric Heater						
Meg Ohms	(L1/GND)	(L2/GND)	(L3/GND)	(L1/GND)	(L2/GND)	(L3/GND)

Installation Comments/ Notes:

Customer Representative: _____ **Date:** _____

PRODUCT REGISTRATION

PSB requests all OWNERS to register the dryer with the factory. Your information and feedback is essential in providing the highest quality product and to continuously improve our dryers. Additionally, PSB can recommend spare parts to allow the dryer to be maintained and provide years of trouble free operation.

Please provide the following information:

COMPANY / ORGANIZATION: _____

CONTACT NAME: _____

CONTACT TITLE: _____

EMAIL: _____

PHONE: _____

DRYER MODEL: _____

DRYER S/N: _____

DATE DRYER WAS INITIALLY COMMISSIONED: _____

PLEASE RETURN INFORMATION TO PSB

- VIA FAX: 814-454-3492
- VIA EMAIL: PSB@GENAIR.NET
- VIA PHONE: 814-453-3651 X 1210



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