



INNOVATIVE AIR
TECHNOLOGIES

Operating Sequence

Serial Number: Sample

Date: Sample

Operating Sequence

Move the selector switch on the control panel to either the ON or AUTO position to start the unit. If the selector switch is in the AUTO position, the unit will not start until the (external) auto run contact is closed, or the run command is issued through MODBUS.

The process fan will start and will run at the speed set on the HMI screen or the speed from the Analog Input. Once the process fan is running, the reactivation fan will start and the desiccant wheel will begin rotating.

When air flow is sensed by the process air pressure switch, the following functions will be enabled:

- Post cooling – If the condensing unit is enabled, the hot gas valve will be switched to maintain the desired post cooling temperature.

When the reactivation pressure switch senses reactivation airflow and no other relevant alarms exist in the system, the reactivation heat valve will be modulated to maintain the reactivation temperature setpoint, which is automatically calculated based on the conditioned space dewpoint setpoint.

To shut down the system, move the selector switch on the control panel to the off position, or remove the automatic run signal (from both Modbus address and external contact). The process fan will immediately shut down, along with the cooling unit and post heater. The reactivation fan and wheel will continue to run until the reactivation temperature falls below 120 degrees F.

Operator Interface Screen

Shortly after power is supplied to the machine, the following will appear on the operator interface screen.



To monitor the system and change setpoints, touch the **ENTER SYSTEM** button. A keypad, similar to the one shown below will appear.

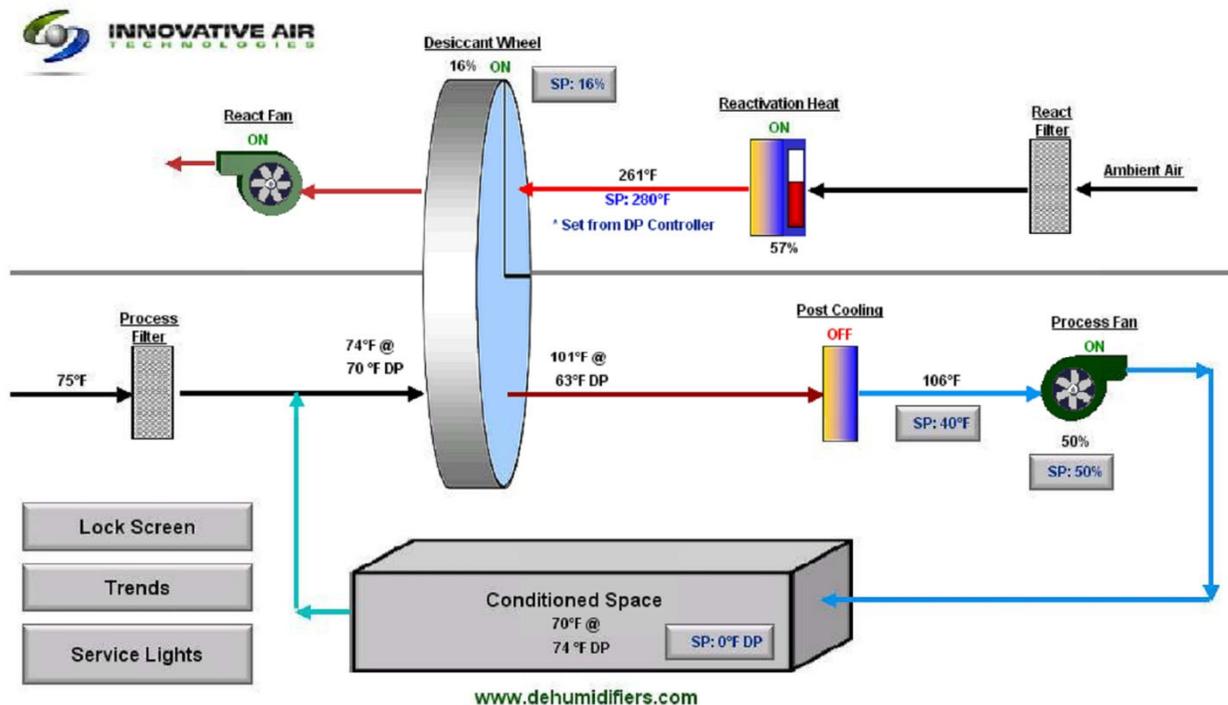


Enter the security code and press the **ENT** button to display the machine's main monitoring screen. The security code will be the machine's serial number (2469 or 2470).

To access any of the machine's setup parameters, touch the **TECHNICAL SUPPORT** button on the screen. No security code is required to display the technical support screen. The LED service lights inside the unit can be activated by touching the **SERVICE LIGHTS** button. Touch the button again to deactivate the lights.

Main Monitoring Screen

The main monitoring screen will be displayed either by touching the **ENTER SYSTEM** button on the lock screen, or by touching the **SYSTEM MONITOR** button from any other screen. The main monitoring screen will appear similar to the figure shown below.



Status Indicators

The screen contains the following status indicators:

- Reactivation Fan: Will be shown as on (and graphic of fan will be turning) when feedback is received from the fan motor starter.
- Desiccant Wheel: Will be shown as on when feedback is received from the wheel VFD. *Note: the desiccant wheel will remain turning until the reactivation fan stops.*
- Reactivation Heat: Will be shown as on when the following conditions are satisfied:
 - Unit is running
 - Feedback signal received from the reactivation fan
 - Feedback signal received from desiccant wheel
 - Reactivation pressure switch is made
 - Reactivation temperature switch is made
 - Reactivation temperature (as shown on screen) is less than 320 degrees
 - “Wheel Not Turning (Proof Switch)” alarm is not displayed on screen
- Process Fan: Will be shown as on when the feedback signal is received from the process fan VFD. The process fan should be running anytime a run command is active within the unit.
- Post Cooling: Will be shown as on when the post cooling is enabled and the process air pressure switch shows sufficient air flow.
- Post Cooling Hot Gas: Will be on when the post cooling condensing unit is on, and the post cooling temperature falls one degree or more below the setpoint. The hot gas valve will remain on until the temperature rises one degree above the setpoint.

Desiccant Wheel Speed

The speed of the desiccant wheel can be adjusted by touching the **Adjust** button near the wheel status indicator. Enter a number between 0 and 100%. *Note: entering a number that is too low can cause a “Wheel Not Turning” alarm.*

Process Fan Speed

The speed of the process fan can be adjusted by touching the **Adjust** button near the fan. Enter a number between 0 and 100%. *Note: entering a number that is too low can cause a “Process Pressure Switch” alarm.*

Conditioned Space Dewpoint

The desired conditioned space dewpoint can be entered by touching the adjust button near the dewpoint display and entering the desired values.

Note: the conditioned space dewpoint can be set using the value entered from the HMI or through the MODBUS interface.

Post Cooling

If the condensing unit is enabled (using the HMI button), the post cooling hot gas valve will be switched to maintain the desired post cooling temperature. For the post cooling to be energized, the process fan must be running, and the process pressure switch must be made.

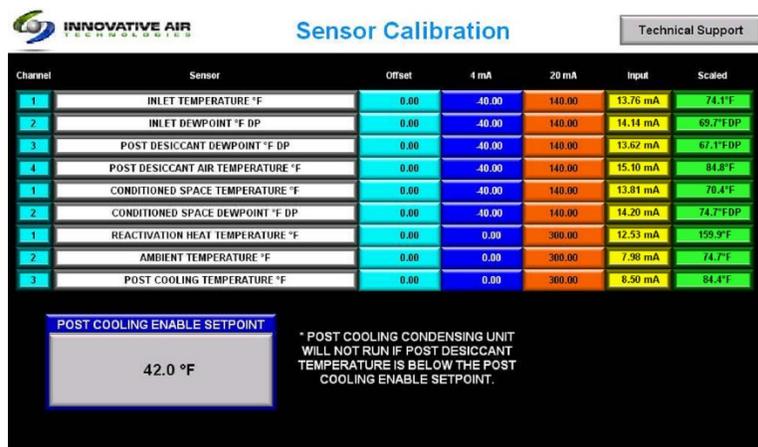
Technical Support Screen

Machine setup parameters are available by selecting additional screens from the technical support screen, as shown below. A second security code is required to enter several of the setup screens. The security code required is the machine serial number with a 1 on the end (Example: serial number 2469 – security code 24691, serial number 2470 – security code 24701).



Sensor Calibration Screen

The sensor calibration screen is used to calibrate the sensors used in the unit. For all analog sensors except thermocouples, the high and low end of the scales can be adjusted, as well as adding a simple offset to the scaled value. For thermocouples, a simple offset is available.



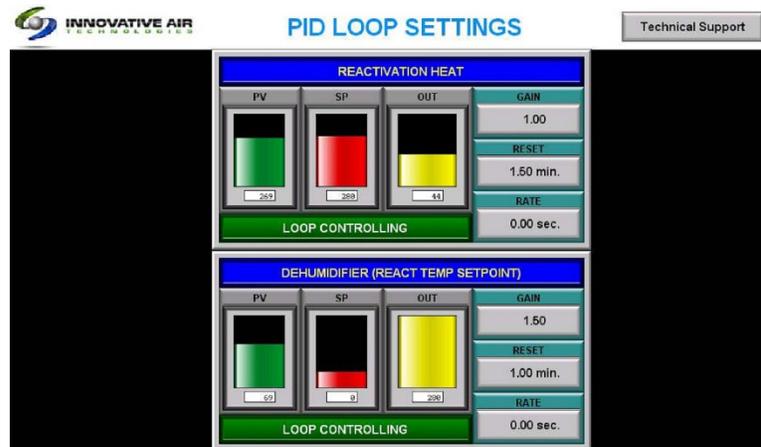
To enter a value for any parameter, touch the box associated with the parameter, and enter the new value using the pop-up keypad.

PID Loop Settings Screen

This system utilizes two PID control loops:

- Reactivation Temperature (Reactivation Heat) – Active when reactivation contactor is energized.

- Conditioned Space (Return Air) Dewpoint – Active when process fan is running. The output from the dewpoint loop is used to calculate the reactivation heat setpoint.



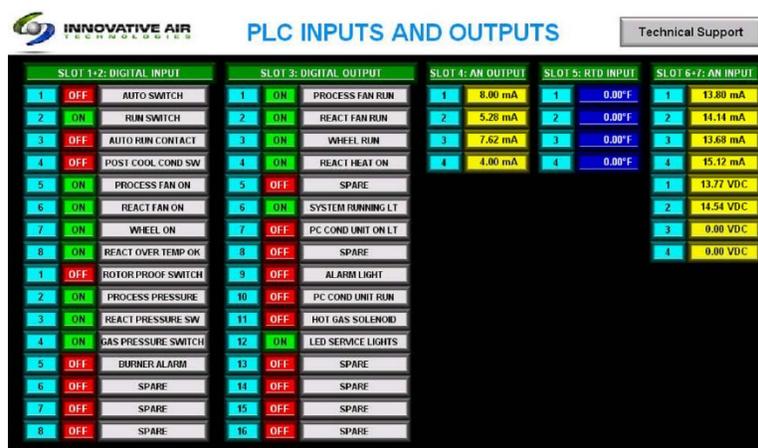
The responsiveness of each control loop can be adjusted by changing the gains associated with the loop.

- Gain (P): Entering a higher number will make the control output respond more with the same error between the process variable and the setpoint.
- RESET (I): Entering a lower number will cause the system to respond faster.
- Rate (D): Entering a higher number may help smooth out process disturbances.

Warning: Changing values can cause the system to become unstable. Please refer to external references on PID loop tuning or a qualified technician if changes are required.

PLC I/O Monitoring

The PLC I/O Monitoring Screen gives a visual indication of the status of all controller input and outputs, as shown below.



SLOT 1-2: DIGITAL INPUT		SLOT 3: DIGITAL OUTPUT		SLOT 4: AN OUTPUT		SLOT 5: RTD INPUT		SLOT 6-7: AN INPUT	
1	OFF	AUTO SWITCH	1	ON	PROCESS FAN RUN	1	8.00 mA	1	0.00°F
2	ON	RUN SWITCH	2	ON	REACT FAN RUN	2	5.28 mA	2	0.00°F
3	OFF	AUTO RUN CONTACT	3	ON	WHEEL RUN	3	7.62 mA	3	0.00°F
4	OFF	POST COOL COND SW	4	ON	REACT HEAT ON	4	4.00 mA	4	0.00°F
5	ON	PROCESS FAN ON	5	OFF	SPARE			1	13.77 VDC
6	ON	REACT FAN ON	6	ON	SYSTEM BURNING LT			2	14.54 VDC
7	ON	WHEEL ON	7	OFF	PC COND UNIT ON LT			3	9.00 VDC
8	ON	REACT OVER TEMP OK	8	OFF	SPARE			4	0.00 VDC
9	OFF	ROTOR PROOF SWITCH	9	OFF	ALARM LIGHT				
10	ON	PROCESS PRESSURE	10	OFF	PC COND UNIT RUN				
11	ON	REACT PRESSURE SW	11	OFF	HOT GAS SOLENOID				
12	ON	GAS PRESSURE SWITCH	12	ON	LED SERVICE LIGHTS				
13	OFF	BURNER ALARM	13	OFF	SPARE				
14	OFF	SPARE	14	OFF	SPARE				
15	OFF	SPARE	15	OFF	SPARE				
16	OFF	SPARE	16	OFF	SPARE				

Digital Inputs

Number	Description	Control Functions
1	System Automatic Selector Switch	Places system in automatic mode
2	System On Selector Switch	Turns unit on
3	System Automatic Run Contact	Turns unit on if selector switch is in automatic position
4	Condensing Unit On Selector Switch	Enables the condensing unit
5	Process Fan Running (Feedback from VFD)	Monitors process fan. If this input is not on, other components will not be allowed to start
6	React Fan Running (Feedback)	Monitor react fan. If this input is not on, the reactivation heat is locked out
7	Desiccant Wheel Running (Feedback from VFD)	Monitor Wheel. If this input is not on, the reactivation heat is locked out
8	Reactivation Heat Over Temperature Switch	This switch must be active for the reactivation heat to work
1	Desiccant Proof Switch	Monitor wheel rotation. A limit switch senses the wheel rotation. If the switch is not activated at least once every five minutes, and alarm is generated. An alarm is also generated if the switch is activated for more than thirty seconds.
2	Process Pressure Switch	This switch must be active for post heat to be energized.
3	Reactivation Pressure Switch	This switch must be active for the reactivation heat to work
4	Gas Pressure Switches	These switches must be active for the burner to be energized.
5	Burner Alarm	Burner Controller Alarm Indicator for display
6	Spare	Not Used
7	Spare	Not Used
8	Spare	Not Used

Digital Outputs

Number	Description	Control Functions
1	Process Fan Run	Relay that supplies run command to VFD
2	React Fan Run	Relay that supplies run command to VFD
3	Wheel Motor Run	Relay that supplies run command to VFD
4	Reactivation Heat Contactor	Enables reactivation heat
5	Spare	Spare
6	System Running Pilot Light	Pilot light on panel door to indicate system is running
7	Cooling Enabled Light	Pilot Light on panel door to indicate post cooling system is running.
8	Spare	Not Used
9	Alarm Light	Pilot Light on panel door to indicate an active alarm in the system
10	Post Cooling Condensing Unit Enable Relay	ON when process fan running, process pressure switch is made, and HMI switch is enabled.
11	Post Cooling Hot Gas Valve	ON when post cooling condensing unit is on and post cooling temperature is less than one degree above the setpoint.
12	LED Service Lights	Controlled by buttons on screen. Supplies power to LED Lights
13	Spare	Not Used
14	Spare	Not Used
15	Spare	Not Used
16	Spare	Not Used

Analog Inputs (4-20 mA)

Number	Description	Control Functions
1	Reactivation Temperature	Reactivation Heat Control
2	Ambient Temperature	Display Only
3	Post Cooling Temperature	Post Cooling Hot Gas Control
4	Spare	
1	Pre-Desiccant Dewpoint	Display Only
2	Pre-Desiccant Temperature	Display Only
3	Post-Desiccant Dewpoint	Display Only
4	Post-Desiccant Temperature	Post cooling low temperature lockout
1	Conditioned Space Dewpoint	Reactivation heat setpoint
2	Conditioned Space Temperature	Display Only
3	Spare	
4	Spare	

Analog Outputs (4-20 mA)

Number	Description	Control Functions
1	Process Fan Speed	Manual setting from HMI
2	Wheel Motor Speed	Manual setting from HMI
3	Reactivation Heat Gas Valve	Modulated to maintain reactivation temperature
4	Face and Bypass Damper	Modulated to maintain space dewpoint

Operating Sequence Screen

The operating sequence screen shows a summary of the unit's operating sequence, as shown below.


OPERATING SEQUENCE
Technical Support

To start the unit, move the selector switch to the ON position, or move the selector switch to the AUTO position, and close the external run contact (or Modbus remote run register).

To stop the unit, move the selector switch to the OFF position, or if the selector switch is in the auto position, open the auto run contact (and the Modbus remote run register).

The reactivation fan will continue to run, even after the unit is off, until the react temperature drops below 120 °F.

When the run command is active, the process fan, reactivation fan, and wheel will all start turning. The reactivation heat setpoint will be automatically calculated by the system to maintain the desired dewpoint in the conditioned space.

As long as the reactivation fan is running, airflow is detected by the pressure switch, and no relevant alarms are active, the reactivation heat will be modulated to maintain the desired reactivation temperature.

If the post cooling selector switch is in the on position, the process fan is running, and the required airflow is detected by the process pressure switch, the condensing unit will be energized. When the unit is energized, the hot gas valve will be cycled to maintain the desired post cooling temperature.

If no dehumidification is required for a selectable time period, the reactivation heat, reactivation fan, and wheel will be shut down until dehumidification is once again required.

Sensors are provided for the following:

- *Inlet Air Temperature and Dewpoint
- *Outlet Air Temperature and Dewpoint
- *Conditioned Space Temperature and Dewpoint
- *Reactivation Temperature
- *Post Cooling Temperature
- *Ambient Temperature

Dewpoint Control

The system will automatically adjust the face and bypass damper position to allow air to bypass the wheel and mix with the dry air from the wheel to maintain the output/space dewpoint.

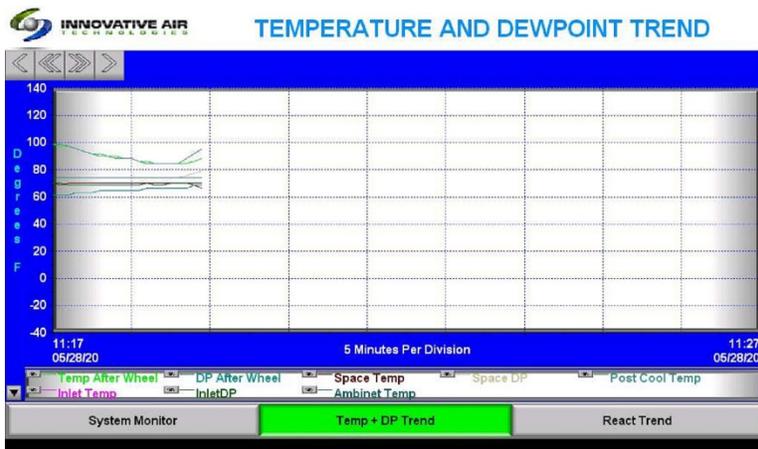
If the dewpoint control output drives the bypass damper to the 100% open position for a period of time and the dewpoint is below the setpoint, the unit will enter economizer mode (react heat/fan and desiccant wheel turn off), and will stay there until the output of the bypass damper drops below 100% open.

INNOVATIVE AIR **HUMIDITY CONTROL SETTINGS** Technical Support

IF THE DEWPOINT CONTROL LOOP OUTPUT IS ZERO FOR A PERIOD OF **3** MINUTES, TURN OFF REACTIVATION HEAT, FAN, AND DESICCANT WHEEL UNTIL LOOP OUTPUT RISES ABOVE ZERO.

Trends

Trends are available for all sensors by touching the TRENDS button on the main screen.



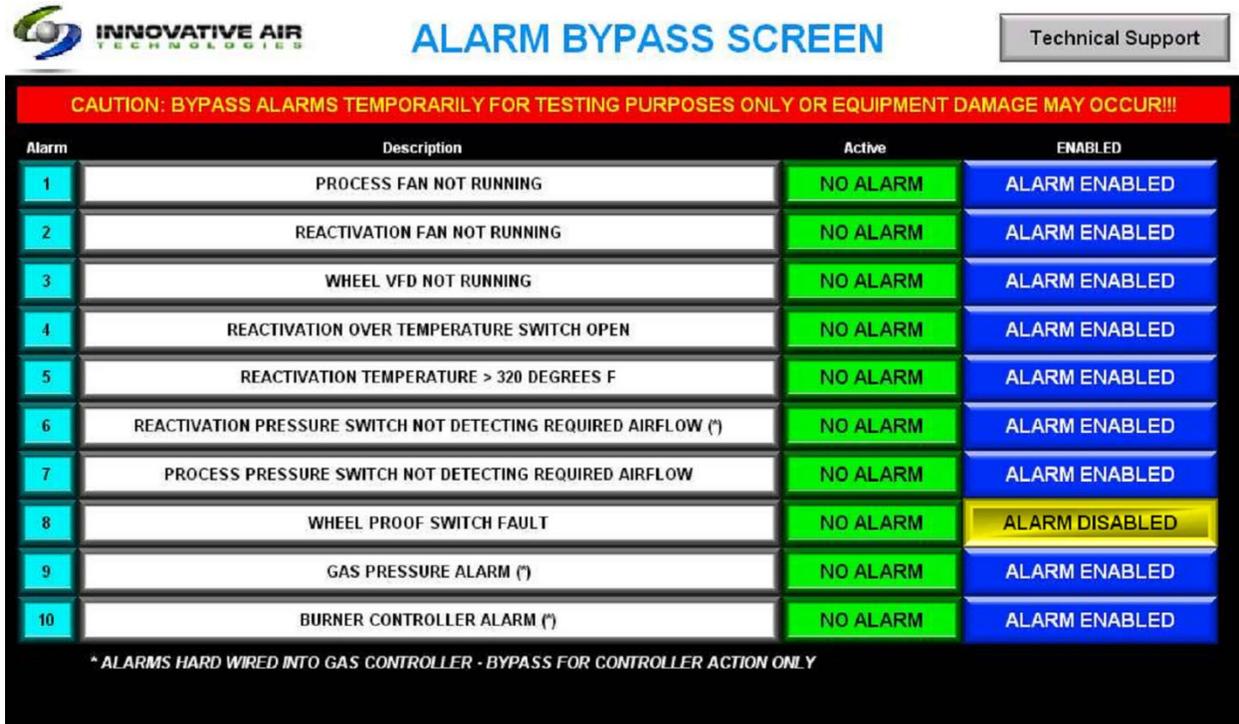
Possible Alarms and Troubleshooting

The table below lists the possible alarms and suggests corrective actions.

#	Description	Cause	Corrective Actions
1	Process Fan Not Running	Process fan run command was given and feedback was not received from VFD within five seconds	Check digital output Y301 for operation. Check digital input X105. If output Y301 is on, but input X105 is not, Check CR505 for operation Check contacts on CR505 Check VFD programming to make sure DRIVE RUNNING is selected as digital output
2	React Fan Not Running	React fan run command was given and feedback was not received from VFD within five seconds	Check digital output Y302 for operation. Check digital input X106. If output Y302 is on, but input X106 is not, Check MCP125 (not tripped) Check MS125 for proper wiring and operation
3	Desiccant Wheel Not Running		Check digital output Y303 for operation. Check digital input X107. If output Y303 is on, but input X107 is not, Check CR509 for operation Check contacts on CR509 Check VFD programming to make sure DRIVE RUNNING is selected as digital output
4	React Temperature Switch Open	Input not received from temperature switch	Verify temperature is not too high Check switch, wiring, and PLC input X108
5	React Temperature High	Temperature is over 320 degrees	Check control loop gains Check operation of gas valve
6	React Pressure Switch Open	Input not received from react pressure switch	Verify react fan is running at sufficient speed Check Input X203 Check switch and wiring Adjust pressure switch
7	Process Pressure Switch Open	Input not received from process pressure switch	Verify process fan is running at sufficient speed Check Input X202 Check switch and wiring Adjust pressure switch
8	Desiccant Wheel Proof Switch	Wheel proof switch was not made within previous five minutes, or react proof switch has been made for more than thirty seconds	Check wheel speed setting is not too low Check operation of wheel proof switch (Input X201)
9	Gas Pressure Alarm	Gas supply pressure to burner is not within range.	Check gas pressures Reset pressure switches Check Input X205

Alarm Bypass Screen

Certain alarms can be bypassed for testing purposes using the alarm bypass screen, as shown below.



CAUTION: BYPASS ALARMS TEMPORARILY FOR TESTING PURPOSES ONLY OR EQUIPMENT DAMAGE MAY OCCUR!!!

Alarm	Description	Active	ENABLED
1	PROCESS FAN NOT RUNNING	NO ALARM	ALARM ENABLED
2	REACTIVATION FAN NOT RUNNING	NO ALARM	ALARM ENABLED
3	WHEEL VFD NOT RUNNING	NO ALARM	ALARM ENABLED
4	REACTIVATION OVER TEMPERATURE SWITCH OPEN	NO ALARM	ALARM ENABLED
5	REACTIVATION TEMPERATURE > 320 DEGREES F	NO ALARM	ALARM ENABLED
6	REACTIVATION PRESSURE SWITCH NOT DETECTING REQUIRED AIRFLOW (*)	NO ALARM	ALARM ENABLED
7	PROCESS PRESSURE SWITCH NOT DETECTING REQUIRED AIRFLOW	NO ALARM	ALARM ENABLED
8	WHEEL PROOF SWITCH FAULT	NO ALARM	ALARM DISABLED
9	GAS PRESSURE ALARM (*)	NO ALARM	ALARM ENABLED
10	BURNER CONTROLLER ALARM (*)	NO ALARM	ALARM ENABLED

* ALARMS HARD WIRED INTO GAS CONTROLLER - BYPASS FOR CONTROLLER ACTION ONLY

Modbus Registers

See separate documentation for Modbus registers and Bacnet converter.