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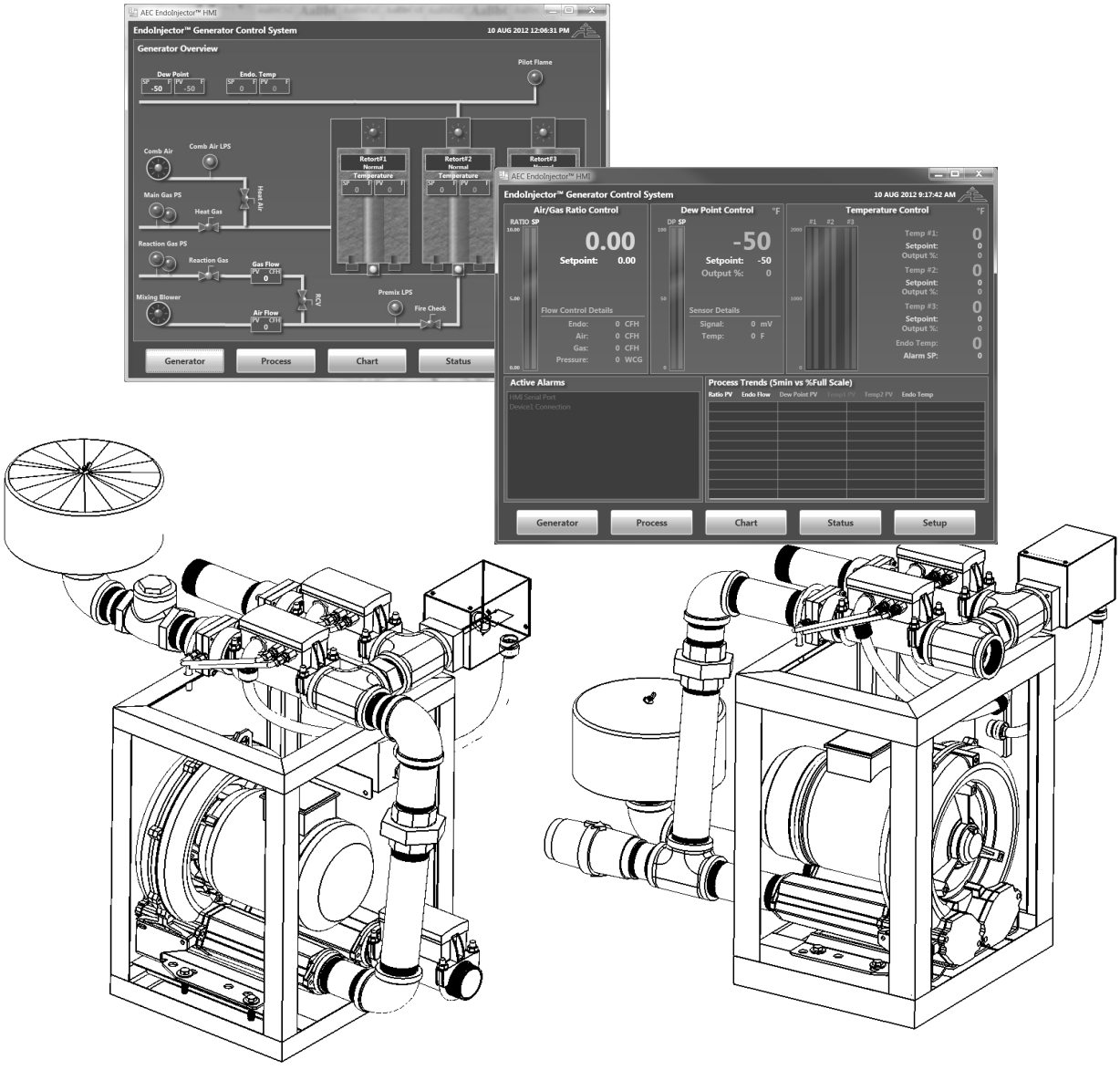
ENDOINJECTOR™ V5
INSTALLATION AND OPERATION MANUAL
(FOR HIGH AND LOW GAS PRESSURE APPLICATION)



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NOTICE, CAUTIONS, AND WARNINGS

NOTICE
This Bulletin contains important safety information and should be read and understood by all individuals who install, operate, or service this equipment.

Failure to follow the precautions and recommendations of this manual may subject personnel and property to dangerous conditions.

WARNING
The valves provided by Atmosphere Engineering are designed to provide precision gas flow control and DO NOT provide positive gas shut off. Failure to use automatic isolation valves may cause flammable gases to leak into the equipment. Properly rated and regularly inspected gas isolation valves shall be installed regularly and inspected on the gas supply lines feeding Atmosphere Engineering equipment per the guidelines outlined in the National Fire Protection Agency publication NFPA86.

Endothermic Gas contains high concentrations of Carbon Monoxide and other dangerous and flammable gasses that can cause fire, asphyxia, or possible brain damage at elevated levels. It is strongly recommended that generator operators and maintenance personnel ventilate the area surrounding the generator and use carbon monoxide monitors to ensure a safe environment when working around any endothermic gas generator.

CAUTION
The EndoInjector™ is designed to accurately mix air and gas together and precisely control the mixture ratio to produce high quality endothermic gas. However, setting the air gas ratio outside the recommended values described in this manual could subject personnel and property to dangerous conditions. Only properly trained and experienced personnel shall operate and maintain the EndoInjector™ generator control system.

TECHNICAL ASSISTANCE

Contact Atmosphere Engineering with all questions or concerns regarding the installation, operation, and setup of the EndoInjector™ mixing system.

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EXPRESS WARRANTY ON ATMOSPHERE ENGINEERING EQUIPMENT

ATMOSPHERE ENGINEERING COMPANY (AEC) warrants products for a period of one (1) year from the date of shipment from AEC to the original purchaser to be free from defects in material and workmanship under normal recommended use, service, inspection, and maintenance. Normal recommended use, service, inspection, and maintenance, mean:

1. Not to be used in excess of nor below the rated capacity, pressure, and temperature ranges specified in the applicable quotation, purchase order, acknowledgment, marketing literature, nameplate, specification sheet, or the Installation, Operation, Inspection, and Maintenance Manual (THE MANUAL); and

2. Using only clean gases free of solids and other contaminants not considered constituents of the gas; and

3. Installation, operation, inspection, and maintenance in compliance with THE MANUAL; and

4. The AEC products being used only in:

    a. Ambient environments lower than 132 °Fahrenheit (54 °Celsius) unless specifically designed and so labeled by AEC for higher temperatures; and
    b. Non-corrosive environments; and
    c. Completely protected from moisture, rain, snow, or other outside environments; and
    d. Not to be used below 32 °Fahrenheit (0 °Celsius) unless precautions are taken for low temperature conditions as shown in THE MANUAL.

5. Being used only for applications permitted by THE MANUAL or other AEC literature or special applications approved in a separate written authorization by AEC.

WARRANTY EXCEPTIONS

This Warranty does not apply to damage caused by any or all of the following circumstances or conditions:

1. Freight damage;

2. Parts, accessories, materials, or components not obtained from nor approved in writing by AEC;

3. Any consequential or incidental damages including but not limited to loss of use, loss of profits, loss of sales, increased costs, arising from the use of any product system or other goods or services manufactured, sold, or provided by AEC;

4. Misapplication, misuse, and failure to follow THE MANUAL or other literature, instructions, or bulletins (including drawings) published or distributed prior to THE MANUAL.

The exclusive remedy under this Warranty or any other express warranty is the repair or replacement without charge for labor and materials of any AEC parts found upon examination by AEC to have been defective. Since certain AEC equipment is heavy, bulky and not deliverable by U.S. mail or other parcel service, AEC equipment may be returned only upon written consent of AEC and then only to the location designated by AEC. Generally such consent will be given only upon the condition that the customer assume and prepay all carrier charges and responsibility for damage in transit.

Purchasers of AEC products, equipment, goods, or services waive subrogation on all items covered under their own or any other insurance.

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EXPRESS WARRANTY ON ATMOSPHERE ENGINEERING EQUIPMENT
(CONTINUED FROM PREVIOUS PAGE)

DISCLAIMER

THIS WARRANTY IS EXCLUSIVE. AEC EXPRESSLY DISCLAIMS ANY AND ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY PURPOSE.

No person, including dealer, seller, or other representative of AEC is authorized to make, on behalf of AEC, any representations beyond those contained in AEC literature and documents or to assume for AEC any obligations or duties not contained in this Warranty and Warranty Policy.

AEC reserves the right to make design and other changes, modifications or improvements to products, services, literature, or systems, without any obligation, to furnish or install same on any previously sold or delivered products or systems.

LIMITATION OF LIABILITY

It is expressly agreed that the liability of AEC is limited and AEC does not function as an insurer. The purchaser and/or user agree that AEC is not liable for loss, harm, or damage due directly or indirectly to any occurrence or consequences there from. If AEC should be found liable to anyone on any theory (except any express warranty where the remedy is set forth in Section 2 of this Warranty and Warranty Policy) for loss harm or damage, the liability of AEC shall be limited to the lesser of the actual loss, harm or damage or the purchase price of the involved AEC equipment or service when sold (or when service performed) by AEC to customer. This liability is exclusive and regardless of cause or origin resulting directly or indirectly to any person or property from:

1. The performance or nonperformance of any obligations set forth in this Warranty and Warranty Policy;
2. Any agreement including specifications between AEC and the customer;
3. Negligence, active, passive or otherwise of AEC or any of agents or employees;
4. Breach of any judicially imposed warranty or covenant of workmanship, durability or performance; and
5. Misrepresentation (under the Restatement, common law or otherwise) and/or strict liability involvement;
6. Liability for fraud-in-the-inducement.

WARRANTY FIELD SERVICE

If Warranty Field Service is rendered at the request of the purchaser or user and the difficulty is found not to be with AEC's product, the purchaser shall pay the time and expense (at the prevailing rate at the time of the service) of AEC's field representative(s). Charges for service, labor, and other expenses that have been incurred by the purchaser, customer, or agent without written approval of AEC will not be accepted. The OEM or other reseller is responsible for transmitting installation and operating instructions, THE MANUAL or other service literature supplied by AEC with the equipment.

(END OF WARRANTY TEXT)

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DESCRIPTION

Mixing System
The EndoInjector™ is a precision gas mixing system and endothermic gas generator control system integrated into one package. The patented EndoInjector™ mixing system designed by Atmosphere Engineering utilizes electronic flow measurement and a precision gas injection valve to constantly monitor and control the ideal gas mixture required to generate high quality endothermic gas.

The EndoInjector™ incorporates the latest technology in regenerative blower design that is capable of significant turndown for single and multi-retort generators. When combined with the patented mixing system, the EndoInjector™ delivers flow on demand throughout the working range of any generator down to 20% of rated capacity. This feature eliminates endothermic gas waste during production while maintaining the precise gas mixture and ratio adjustment capability required to control gas quality throughout the turndown range.

Dew Point Control
The integrated dew point control logic of the EndoInjector™ will monitor the endothermic gas quality then precisely modify the air gas mixture to control the quality of the endothermic gas. The sensor required to monitor this gas is not included with the EndoInjector system but can be purchased separately from Atmosphere Engineering.

Temperature Control
The integrated temperature control logic of the EndoInjector™ will monitor a single temperature zone or multiple temperature zones and provides an output (relay or signal) that can be used to accurately control the temperature of any endothermic gas generator. The thermocouple required to monitor temperature and valves required to control temperature are not included with the EndoInjector™ system but can be purchased separately from Atmosphere Engineering.

Paperless Chart Recorder
The EndoInjector™ integrates a full-color touch-screen paperless chart recorder to monitor all critical process variables of an endothermic gas generator. The data and backup files are stored and maintained on the touch-screen in an encrypted format for a period of 5+ years. The data can be exported to CSV format for easy review within an spreadsheet application (i.e. MS Excel or similar).

Custom Designed System
The EndoInjector™ is a precision mixing system that is assembled, calibrated, and fully tested to perform to the exact requirements of a specific endothermic gas generator. The system is not designed to be interchangeable with any other generator without written approval of the new generator application from Atmosphere Engineering.

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SPECIFICATIONS

Maximum Flow Capability .....Calibrated to Order – Indicated on Serial Tag
Minimum Flow Range.....20% of Maximum Flow
Temperature Limits.....32°F to 130°F
Flow Meter Pressure Limits .....5 psig maximum
Inlet Gas Supply Pressure .....0.25 - 3 psig (min-max)
Control Power Required.....85-264VAC (50/60 HZ)

Horsepower .....1.25 HP
Power Supply.....3 Phase 230/460 VAC 50/60 Hz
Power Required.....0.93 kW

Horsepower .....3.50 HP
Power Supply.....3 Phase 230/460 VAC 50/60 Hz
Power Required.....2.55 kW

MODBUS COMMUNICATION

Standard communication between the HMI and the control system is handled via ModbusRTU (RS232 or RS485) or ModbusTCP/IP (Ethernet) as required. Additional communications ports are available but can vary by type depending on the control system specified when ordering and provided with the system. A modbus register address list and other communication details are provided as an attachment to this manual. Contact Atmosphere Engineering support team with any questions regarding communication setup of this device.

CAUTION: REMOTE CONNECTION CONSIDERATIONS

Connection of industrial equipment to a remote network opens the system to security and safety vulnerabilities. Access to any industrial equipment including the EndoInjector™ over a network must be strictly controlled so that only those trained in the operation of the equipment can modify parameter values within the system. Further, precautions should be integrated to prevent parameters from being modified accidentally and set to values outside of safe ranges.

DATA STORAGE

The HMI touchscreen includes a minimum of 7GB of unused internal hard drive space. The EndoInjector™ daily encrypted log files are contained within the AEC log directory and a backup file is located in a backup directory. The combined daily file size will consume approximately 300KB per day. Therefore, the actual capacity of the hard drive will be able to maintain over 60 years of log data. However, due to memory life considerations the process log data integrity should be considered maintained locally at the machine for a period of 5+ years. Of course, the actual data may last longer and can be backed up remotely for an indefinite period.

ELECTRICAL COMPONENT OVERVIEW

The EndoInjector™ mixing system can be supplied with many different types of controllers depending on customer specifications and specific generator control requirements. The electrical components that are not part of the mechanical assembly are typically packaged separately and found in a box that accompanies the system. Refer to the electrical wiring diagram and material list attached to this manual and ensure that each item detailed in the attached drawing is accounted for and has not experienced physical damage during shipment prior to proceeding with the installation.

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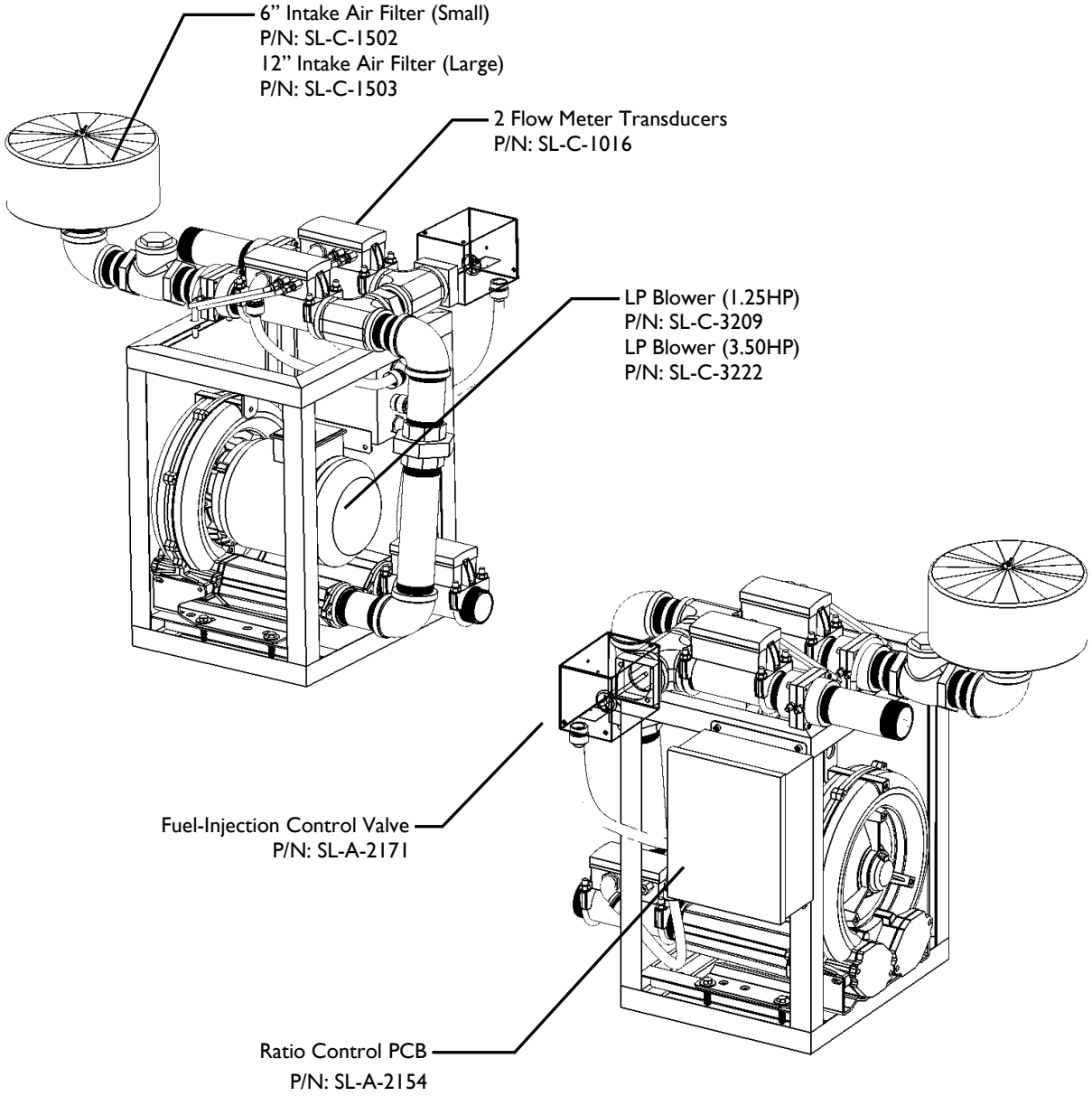
MECHANICAL COMPONENT OVERVIEW

The EndoInjector mixing system is supplied in either an "HP" (High Pressure Gas Supply) or "LP" (Low Pressure Gas Supply) configuration. The system that accompanies this manual can be identified as either HP or LP by reviewing the packing slip paperwork or by reviewing the mechanical system as detailed below.

Every EndoInjector™ contains many individual components that are calibrated, and fully tested to perform as a complete system. The components can be supplied preassembled or as separate sub-assemblies depending on the installation requirements. The diagram(s) below detail the main critical mechanical components of the system. Review each critical component and ensure there is no physical damage to these components during shipping before proceeding to install the system.

(LP) Configuration Overview



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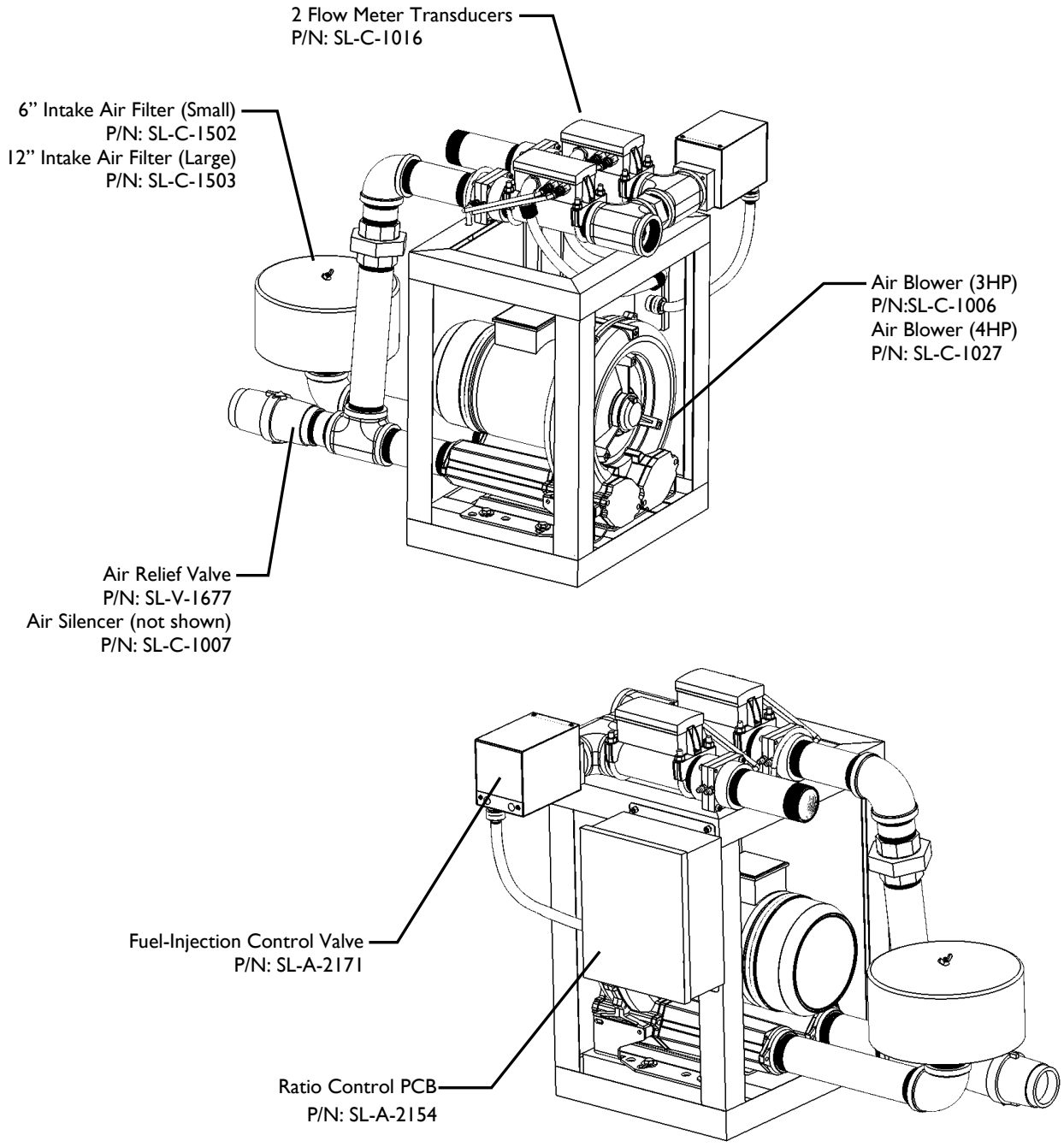
MECHANICAL COMPONENT OVERVIEW *(CONTINUED)*

(HP) Configuration Overview



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INSTALLATION NOTICE

Only qualified personnel experienced with endothermic gas generator operation and safety requirements shall perform an EndoInjector™ installation. It should be noted that additional mechanical components and interlocks will be required on the generator other than those supplied with the EndoInjector™ system to ensure the generator is safe and meets NFPA 86 (or similar) guidelines.

The EndoInjector™ is a robust industrial device however; some precision measurement components may be susceptible to damage from severe shock. Care should be taken to handle the system during the installation process. The system was not designed to support personnel and should not be used as a step or a support as this could damage components on the system and may cause injury.

MECHANICAL INSTALLATION

Installation Procedure (Refer to pipeline diagram attached to manual for proper installation)

1. Inspect the mixing system for any damaged or missing components and confirm each component detailed in the "Mechanical Component Review" section of this manual is accounted for based on the configuration provided.

2. Make note of the following locations on the mixing system and consider the best location for the mixing system on the generator to accommodate the piping and access requirements to reach these locations:
    a. Gas Supply Inlet
    b. Mixed Gas Outlet
    c. Air Intake Filter
    d. Air Relief Valve (HP configuration only)

3. Secure the mixing system to the generator frame using mounting holes on the base of the system. If retrofitting a generator, the old blower motor location is typically a suitable location. The mixing system should be mounted level and should be reasonably insulated from direct radiant heat sources.

4. Attach the reaction gas supply pipeline to the gas inlet on the mixing system. The gas supply must be pressure regulated to a minimum of 0.5 psig and a maximum of 3 psig. Note that the reaction gas piping must contain the required interlocks and components to meet NFPA 86.

5. Attach the mixed gas outlet to an appropriate automatic fire check valve and install a low pressure air switch to confirm blower operation.

6. Install the Outlet Pressure Transducer to a sense line attached to the generator outlet (after the cooler(s) but before any valves).

7. Install Air Intake Filter.

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MECHANICAL INSTALLATION
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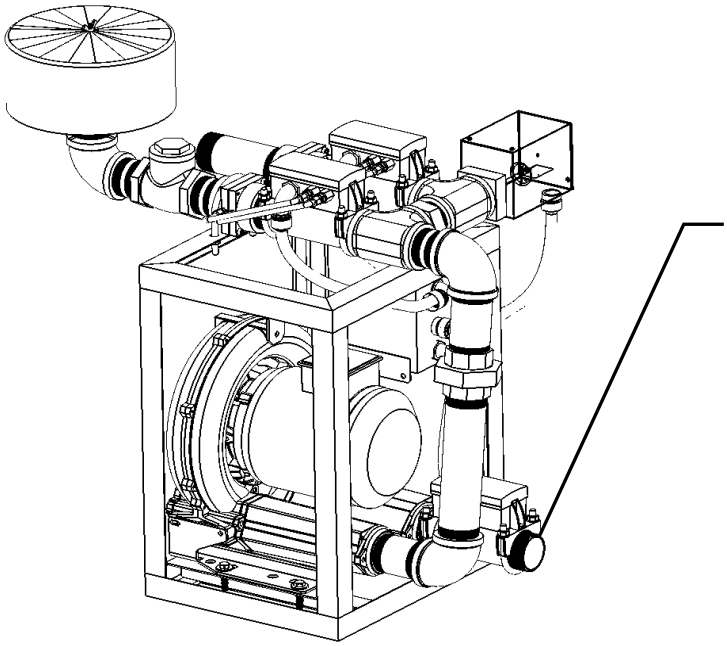
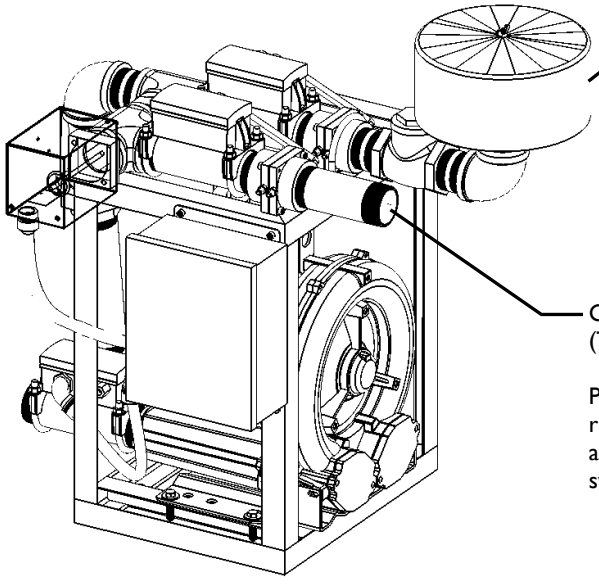
The following connections shall be made as described.

(LP) Configuration



Mixing System Outlet
(Typical: 2"NPT Female)

This is mixing system outlet that should be piped to fire check valve with low pressure switch to confirm blower operation before gas is enabled.



Air Intake Filter
(6" Style Pictured)

Access to this point is required to change filter when required.

Gas Supply Inlet
(Typical: 2" Male)

Properly regulated and interlocked reaction gas supply pipeline with automatic gas safety shutoff and pressure switches should supply reaction gas here.

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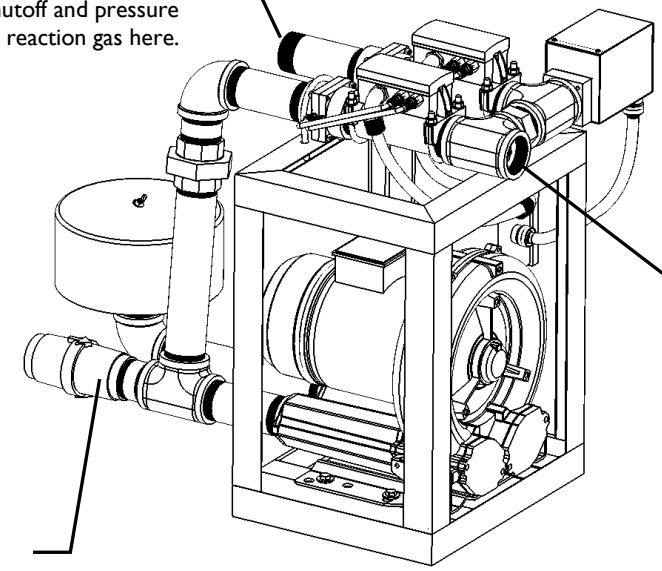
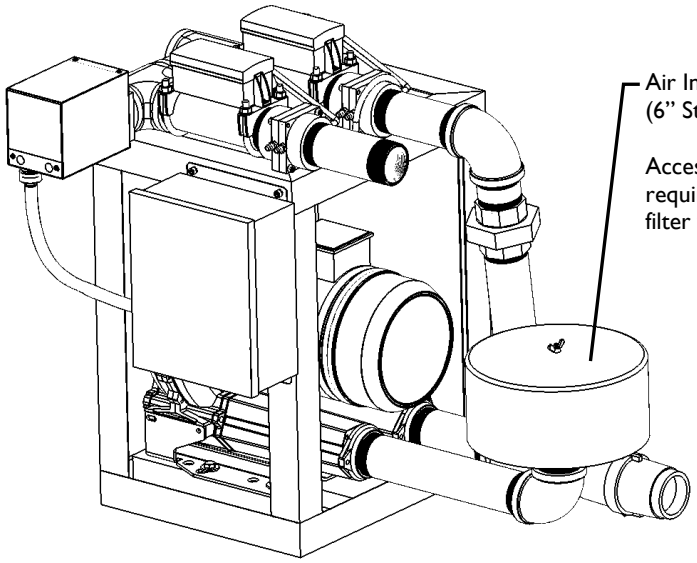
MECHANICAL INSTALLATION
(CONTINUED FROM PREVIOUS PAGE)

The following connections shall be made as described.

(HP) Configuration





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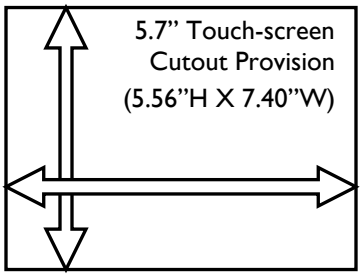
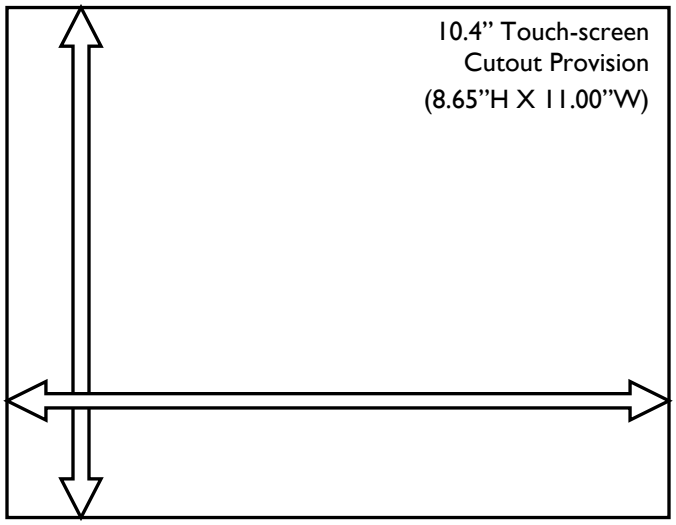
ELECTRICAL INSTALLATION

It is important to note that there are many different generator manufacturers and the wiring designs and control logic can be very different depending on the manufacturer and age of the generator. Only a qualified electrician experienced with endothermic gas generator operation and current safety requirements shall perform an EndoInjector installation. Proper safe electrical interlocks must be designed to meet safe generator operation based on NFPA86 guidelines. If necessary, installation supervision and direction of turnkey installation services are available from Atmosphere Engineering or an AEC certified installation professional. The primary consideration is that the EndoInjector™ control system is designed to provide the temperature control, dew point control, and air gas ratio control of an endothermic gas generator. Basic electrical installation includes:

1. Mount the industrial touch-screen supplied with the system into generator control enclosure and ensure the screen is protected from close proximity to direct radiant heat sources or other excessive heat. Ensure proper cutout and do not force into cutout or over tighten mounting brackets as it may deform the touch-screen and cause the touch panel to malfunction.





2. Mount the 24VDC power supply, process controller, and relays supplied with the EndoInjector™ system inside the controls enclosure. If retrofitting to existing generator it is typical to remove temperature and dew point controllers installed on generator. However, it is important to make detailed notes of wiring numbers and their purpose so that final terminations can be made with the EndoInjector™ control system.

3. Wire the EndoInjector™ blower motor.
   IMPORTANT
   Make sure to check the terminal jumpers inside the motor wiring box and confirm they are positioned properly for the voltage being supplied. (Note: To reduce electrical noise in the DC circuits, it is recommended that the high voltage motor wiring should be conveyed through a separate conduit from any low voltage control wiring.)

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ELECTRICAL INSTALLATION

(CONTINUED FROM PREVIOUS PAGE)

4. Wire the mixing system control components together as shown on the attached installation wiring diagram. This wiring diagram only details the control system assembly and integration between mixing system, HMI, and sensors. The wiring diagram and does not detail the required integration wiring between the control system and the generator panel and components. This is because the integration wiring and wire numbers will be dependent on the manufacturer and age of the generator equipment. It is important to have a detailed wiring diagram of the generator to use as a guide to locate wire numbers and terminal locations required for proper EndoInjector™ installation and safe generator operation. After the wiring detailed on the attached installation diagram is completed, review the following check list as a guide to ensure proper integration of the relays and control outputs are made to the generator.

    a. Low Temperature Alarm: The low temperature alarm relay is only energized when the generator temperature is high enough to safely start the mixing system. A normally open contact on this relay should be used in the motor starter circuit to ensure the temperature is safe before the EndoInjector™ mixing system can be allowed to start.

    b. Critical Alarm Relay (System Enable): The critical alarm relay is only energized when all internal checks and ratio control system confirms system is ok to start. If there is a critical failure this relay will be de-energized. Therefore, it is typical to wire a normally open contact on this relay in series with the low temperature alarm relay. This relay is specific to the EndoInjector™ system and will not be part of existing generator wiring.

    c. Temperature Control Output: The EndoInjector™ provides both a relay for time proportional control and a 4-20mA signal output for heat control. Either of these outputs can be used to integrate existing heat control components to control the temperature of the generator. The time proportional relay energizes when calling for more heat. The 4-20mA signal increases when calling for more heat.

    d. Non-Critical Alarm (optional): The Non-Critical alarm relay is simply a deviation alarm relay that will energize when a temperature, dew point, or ratio deviation alarm occurs. The relay will only de-energize when all deviation alarms are ok. Therefore, a horn silence circuit will be required if using this relay to sound a horn.

    e. Horn Output (optional): The horn output is provided on some systems in replacement of the "Non-Critical" alarm. If a horn output is provide, this output is energized when any alarm is present and will de-energize after the silence horn contact is made.

    f. Probe Burnout Relay: The probe burnout relay energizes when requesting a zirconia probe to perform a burnout cycle. The relay will remain energized during the entire probe burnout time (see operation for setting) and then de-energize until the next probe burnout.

    g. Dew Point Wiring: When using a zirconia oxygen sensor to monitor dew point, be sure to wire both the thermocouple and mV signal wire to the controller as detailed on the wiring diagram.

    h. Temperature Control Wire: A thermocouple (Typically: K or S Type) should be wired to the temperature control input of the EndoInjector™ controller. Note that the control thermocouple must be separate from the over temperature safety thermocouple.

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SYSTEM OPERATION

A generator fitted with the EndoInjector™ mixing and generator control system is designed to start and stop the same as a gas generator with a mechanical mixing system. However, the patented advanced control logic and operator interface of the EndoInjector™ mixing system are designed to provide complete monitoring and control of all critical generator variables with an integrated paperless chart recorder to log the generator performance.

The full-color touch-screen provides the main interface between an operator and the EndoInjector™ control system. The EndoInjector™ software is designed to run on any computer operating Microsoft operating system (XP or later) with the .net3.5SP1 Framework or later installed.

COMMUNICATION STATUS

The tip of the logo at the top right of the screen will blink green when communication is established between the HMI and the controller. If the tip is blinking RED then this is an indication that there is no communication link between the HMI and the controller. During startup it may take 5-10 seconds to establish communications however, a prolonged disconnect may be the sign of a communications setup problem or a wiring problem.

SYSTEM NAVIGATION BUTTONS

Generator Button

The "Generator" button is used to display a graphical representation of generator operation and component status. It should be noted that this is just a graphical summary and actual components may be in different locations from those displayed on the generator panel.

Process Button

The "Process" button is used to display the main generator process control values screen.

Chart Button

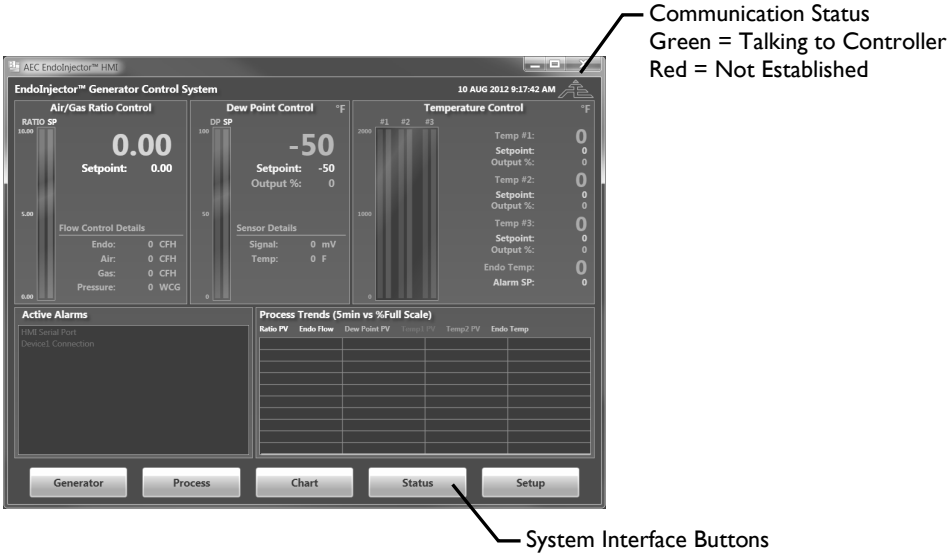
The "Chart" button is used to access the paperless chart recorder.

Status Button

The "Status" button is used to view active system alarms and communications status.

Setup Button

The "Setup" button is used to access the system setup screen. It should be noted that all system parameters are password protected with 3 levels of security to ensure accidental parameter changes cannot occur unless the user is logged in.



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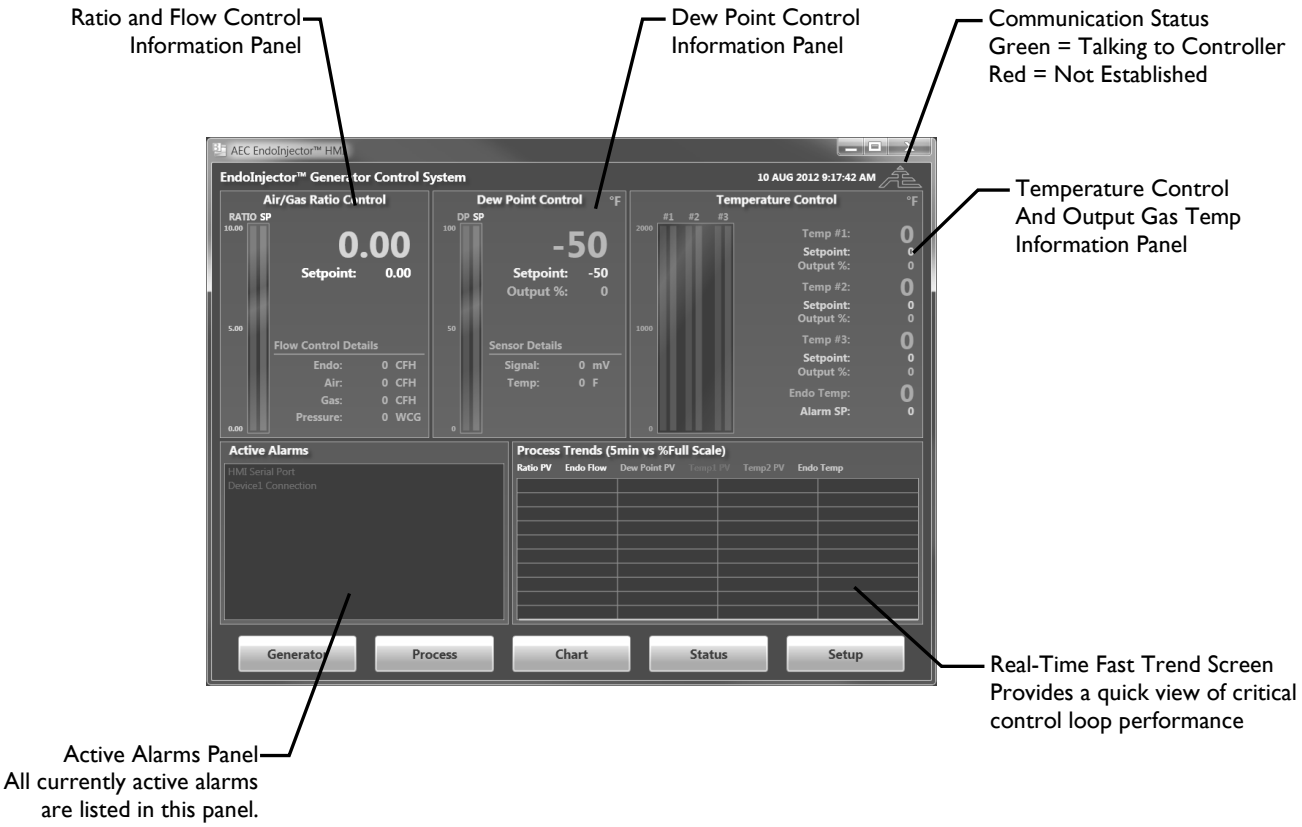
PROCESS SCREEN OVERVIEW



RATIO AND FLOW CONTROL PANEL

The ratio and flow control panel provides detailed information regarding the mixing system operation. Note: The bar graph scales are dependent on the pen scales defined within the paperless chart recorder and can be changed using the "edit pen" button on the history screen.

Air/Gas Ratio is the currently measured air flow divided by the currently measured gas flow passing through the mixing system. This value represents the actual mixture of air and gas being introduced into the gas generator and is directly correlated to the dew point of the endothermic gas produced. The actual ratio is controlled to the "Ratio Setpoint" by the fuel-injection control valve. It should be understood that a higher ratio will produce endothermic gas with a higher dew point.

Ratio Setpoint is the desired mixture of air and gas that should be introduced into the generator. This value can be entered manually or can be controlled automatically by the dew point PID loop output. When controlled automatically, the operator must provide a minimum and maximum ratio setpoint so that the dew point control loop can only change the loop by a limited range.

Endo Flow is a calculated value that represents the amount of endothermic gas being produced by the generator. It is calculated using the following equation: Endo Flow = (Air Flow + Gas Flow) x (Expansion Factor)

Air Flow is the actual calibrated measurement of air passing through the EndoInjector mixing system. This value is measured using the air flow transducer mounted to the mixing system. A calibration curve detailing the transducer performance in relation to the factory calibrated flow measurements is attached to this manual. The air flow meter has integrated test ports that can be used to certify the meter calibration while in operation.

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PROCESS SCREEN OVERVIEW *(CONTINUED)*

Gas Flow is the actual calibrated measurement of gas passing through the EndoInjector mixing system. This value is measured using the gas flow transducer mounted to the mixing system. A calibration curve detailing the transducer performance in relation to the factory calibrated flow measurements is attached to this manual. The gas flow meter has integrated test ports that can be used to certify the meter calibration while in operation.

Endothermic Gas Pressure *(Optional)* indicates the generator output endothermic gas pressure based on pressure transducer.

Premix Gas Pressure *(Optional)* indicates the premix gas pressure before the retort based on pressure transducer.

DEW POINT CONTROL PANEL

The dew point control panel provides detailed information regarding the quality of the endothermic gas being produced by the gas generator. Note: The bar graph scales are dependent on the pen scales defined within the paperless chart recorder and can be changed using the "edit pen" button on the history screen.

Dew Point is the actual dew point of the endothermic gas being produced. The dew point is typically measured by taking a sample of endothermic gas and introducing it to either a zirconia oxygen sensor (probe) or a gas analyzer.

Dew Point Setpoint is the desired dew point that should be produced by the endothermic gas generator. This value is typically entered manually by the operator. The dew point of endothermic gas is directly correlated to the resulting "%Carbon" level within a heat treating furnace. While the dew point will not exactly predict %Carbon inside a furnace, because there are many other variables that determine the %Carbon value in a heat treating furnace, but generally a higher dew point will result in a lower %Carbon value inside a heat treating furnace (all other furnace variables being equal).

%Output value represents the PID control output signal used to change the air/gas ratio setpoint. If the %Output is equal to 100% then the air/gas ratio setpoint will be equal to the maximum air/gas ratio setpoint provided by the operator. If the %Output is equal to 0% than the air/gas ratio setpoint will be equal to the minimum air/gas ratio setpoint. The corresponding values between 0-100% will result in a linear change to the air/gas ratio setpoint.

Sensor Signal is the actual measured signal from the dew point sensor. This value is used to determine the dew point of the endothermic gas sample.

Sensor Temperature *(for probe sensors only)* is the actual measured temperature of the gas sample within the dew point sensor. This value is used to determine the dew point of the endothermic gas sample. Note: The ideal temperature of a zirconia sensor during operation is 1550degF.

TEMPERATURE CONTROL PANEL

The temperature control panel provides detailed information regarding the temperature of the endothermic gas generator. The temperature panel is expandable to 3 separate temperature control loops that can be simultaneously viewed within this panel. Note: The bar graph scales are dependent on the pen scales defined within the paperless chart recorder and can be changed using the "edit pen" button on the history screen.

Temperature is the actual temperature within the hot zone of an endothermic gas generator. This value is measured by an industrial thermocouple. Note: a value of >3000 means that there is an open loop on the thermocouple input and the thermocouple is either not wired correctly or has failed.

Temperature Setpoint is the desired temperature within the hot zone of an endothermic gas generator. This value is typically set by the generator operator to a value of 1900degF or 1950degF for normal generator operation.

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PROCESS SCREEN OVERVIEW *(CONTINUED)*

%Output value represents the PID control output signal used to control the temperature of the generator. The actual output can be either a time proportional (relay type) control or a 4-20mA control signal. If the temperature is lower than the temperature setpoint then the %output will increase. The increase in %output will result in the temperature control relay being energized "more often" and also result in the 4-20mA signal to increase in current.

Output Endo Temperature *(optional)* The system provides a thermocouple input to monitor gas output temperature. This temperature is critical to ensure that the generator cooler is working properly. A high output temperature alarm function is also included. The setup for this output temperature alarm is described in the system setup section of this manual.

PROCESS CONTROL TREND PANEL

The process control trend panel is updated every second to display actual control characteristics of the mixing system that might not be seen on the one minute storage interval of the historical log found in the paperless chart recorder. The trend panel is not the same as the paperless chart recorder in that all the data is updated much more quickly (1 second intervals) and the trend data is not stored longer than 4 minutes. The primary function of the trend panel is to provide real time feedback of system operation to better tune and confirm minimal control oscillations during system operation.

Trend Panel Setup: Double tapping on the trend title will display the trend pen selection menu. Select a value to display for each pen and close the setup screen. Changes are immediate. Note: The trend pen scaling and color is dependent on the setup for those values within the paperless chart recorder and can be changed using the "edit pen" button on the chart screen.

ACTIVE ALARM PANEL

The active alarm panel displays all currently active alarms in RED. Detailed alarm status and alarm history can be found in the "Status" screen that will be displayed by pressing the "Status" button at the bottom of the screen.

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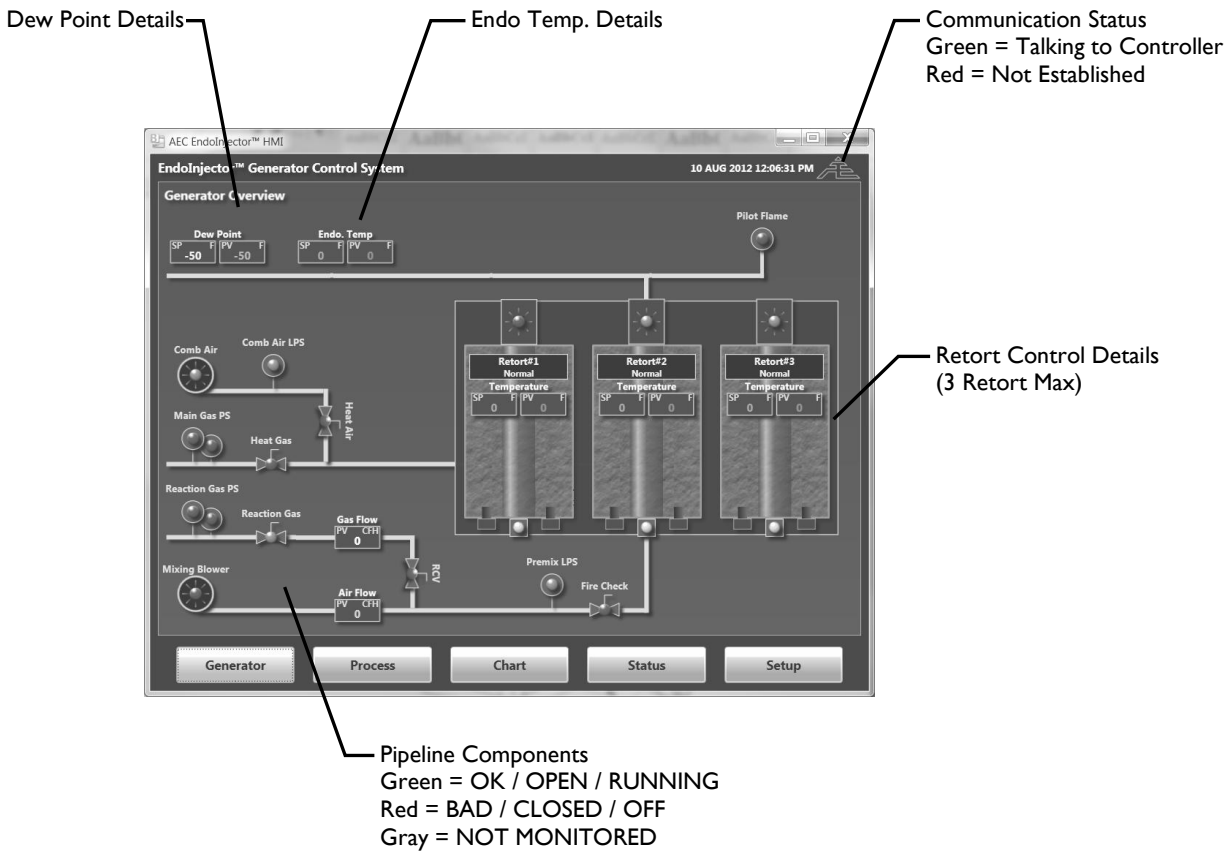
GENERATOR SCREEN OVERVIEW



Pipeline Components

The Pipeline components section is intended for status indication only and should be considered for reference and troubleshooting purposes only. Components shown on this screen indicate the standard generator components found on most generators. However, actual components may differ and/or the location of these components may be different than those pictured in the pipeline diagram. Consult the generator manufacturer drawings and diagrams for actual component locations. If the LED on the screen for a component is "GRAY" then that is an indication that the component is not being monitored by the control system.

Retort Control Details

The retort control section indicates the temperature control, flame sensor, high/low fire, retort inlet valve, and cooler status for each retort. The temperature of the retort will fade from gray thru red to yellow depending on the temperature PV measured by the thermocouple for that retort. A flame will be present when the flame sensor detects a flame and the size of the flame will change depending on the status of the temperature control relay.

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Setup Screen Overview

The setup panel organizes all setup parameters into specific groups. These groups are accessed using the "Parameter Group" buttons located at the top of the setup screen. It should be noted that all parameters are password protected to provide "READ ONLY" access to control parameters. It is not possible to change system parameter setting if not logged into the system.

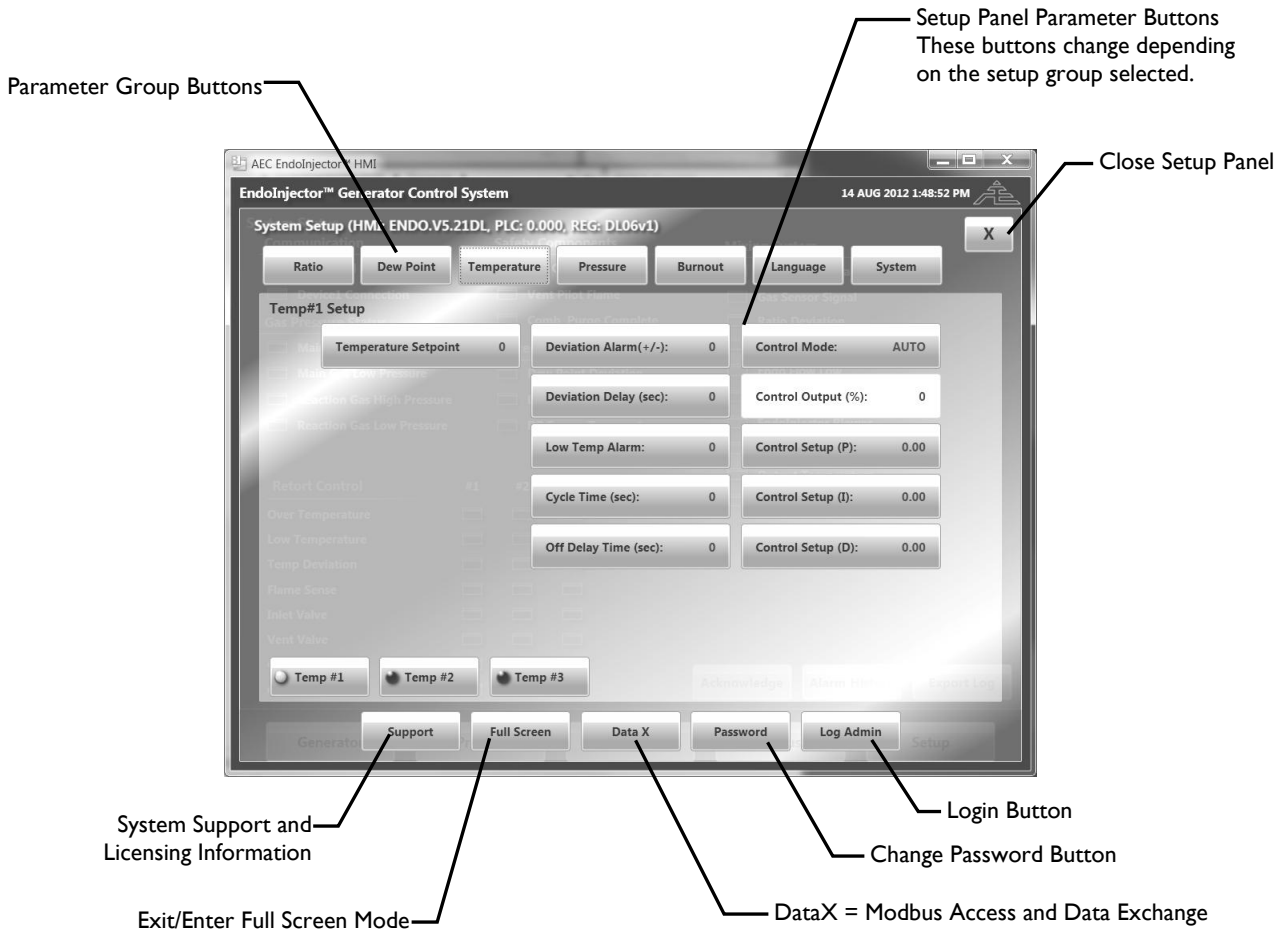
Login Permissions

The EndoInjectorV5 software provides 3 levels of access to the system configuration setup screen.

USER LEVEL (Default = 2): Provides access to standard system set points and tuning variables.

ADMINISTRATION LEVEL (Default = 22): Provides access to critical control parameters and alarm setpoint variables.

ENGINEERING LEVEL (Contact AEC): Provides access to modbus mapping and controller setup functions.



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RATIO SETUP PARAMETER GROUP *(USER, ADMIN, ENG Levels)*
These parameters define the control of the air/gas mixing function of the EndoInjector. Changes to these parameters will take effect immediately. All parameters are only editable in USER, ADMIN, and ENG levels.

Maximum Ratio Set Point *(Default = 3.00)*
Maximum Air/Gas Ratio to be introduced when dew point control output is equal to 100%. The default setting of 3.00 may differ slightly due to specific generator characteristics. If the dew point is too low and the trim signal is 100% then the Maximum Ratio Set Point should be increased to provide proper dew point control. NOTE: Do not set this value above 3.50 as excessive water vapor may be produced within the generator retorts. If the required air/gas ratio approaches 3.50 this could indicate a probe sensor failure or "sooting" of the catalyst within the retort. Consult the generator manual for troubleshooting guidelines or contact Atmosphere Engineering for further support.

Minimum Ratio Set Point *(Default = 2.50)*
Minimum Air/Gas Ratio to be introduced when dew point control output is equal to 0%. The default setting of 2.50 may differ slightly due to specific generator characteristics. If the dew point is too high and the trim signal is 0% then the Minimum Ratio Set Point can be decreased to provide proper dew point control. NOTE: Do not set this value below 2.00 as excessive "sooting" may occur within the generator retorts. If the required air/gas ratio approaches 2.00 this could indicate a probe sensor failure or water collection within the gas sample line. Consult the generator manual for troubleshooting guidelines or contact Atmosphere Engineering for further support.

Ratio Deviation Alarm / Delay *(Default = 0.10 / 30sec)*
This value defines the limit for the ratio deviation alarm and the time required outside of this range before an alarm is sounded. When the actual air/gas ratio deviates from the ratio setpoint by more than this value for mor than the delay time a Ratio Deviation Alarm will occur.

DEW POINT SETUP PARAMETER GROUP *(USER, ADMIN, ENG Levels)*
These parameters define the dew point control for the gas being produced by the gas generator. Changes to these parameters will take effect immediately. All parameters are only editable in USER, ADMIN, and ENG levels.

Dew Point Setpoint
The dew point setpoint is the desired dew point of the generated endothermic gas.

Dew Point Deviation Alarm / Delay
The deviation alarm value determines when a dew point deviation alarm should be triggered.

Control Mode *(Auto/Manual)*
The control mode defines the PID control active status for the dew point control loop. Typically this parameter is left in "AUTO" mode but can be changed to "Manual" mode during system startup to "lock" ratio control at one ratio setpoint to season catalyst or lean out generator.

Control Output (%)
The control output in the dew point setup panel is the same as the %output as detailed on the dew point detail panel on the main screen. The value is READ ONLY when dew point PID control is in AUTO mode. However, the %Output can be changed when PID is in MANUAL mode.

Control PID Values
PID settings can vary widely depending on the controller hardware incorporated with the system. If not familiar with the controller setup parameters for that hardware, contact Atmosphere Engineering for advice regarding initial settings and tuning recommendations.

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TEMPERATURE SETUP PARAMETER GROUP *(USER, ADMIN, ENG Levels)*
These parameters define the characteristics of the temperature control for the gas generator. Changes to these parameters will take effect immediately. All parameters are only editable in USER, ADMIN, and ENG levels.

Temperature Loop Selection Buttons
When more than 1 temperature control loop is activated, the buttons at the bottom of the temperature control setup screen provide a way to toggle which temperature loop is displayed and is edited from the screen. It is important to review these buttons to confirm the correct temperature loop is selected prior to making any parameters changes.

Temperature Setpoint
The temperature setpoint is the desired temperature to control the gas generator hot zone.

Temperature Deviation Alarm / Delay
The deviation alarm value determines when a temperature deviation alarm should be triggered.

Control Mode *(Auto/Manual)*
The control mode defines the PID control active status for the temperature control loop. Typically this parameter is left in "AUTO" mode but can be changed to "Manual" mode during initial system startup or for troubleshooting reasons. It should be fully understood that when the loop is in manual mode, the temperature is not under control and can go higher than desired. It is always recommended to check the over temperature controller (not included with EndoInjector™ system) prior to placing temperature PID in manual mode to ensure temperature will shut down if excessive temperature is reached.

Low Temp Alarm *(Default: 1400F)*
The low temperature alarm is a critical safety setpoint. When the actual control temperature is higher than this value the low temperature alarm relay will energize. This relay must be wired into the motor start circuit for the EndoInjector™ mixing system so that if the temperature goes below this low temperature setpoint the mixing system must stop and the reaction gas must automatically be isolated. The minimum setpoint of this value shall be 1400degF per NFPA 86 guidelines.

Control Cycle Time (sec)
The control cycle time is used to setup time proportional control of the relay output used for temperature control. This time value represents the amount of time to divide between high fire and low fire based on the %output of the temperature control PID loop. The %output represents the % of the control cycle time to remain at high fire. For example, if the Control Cycle time was set to 20 seconds and the temperature control %output was 75% then the temperature control relay would remain energized 15 seconds and de-energized 5 seconds.

Off Delay Time (sec)
Some burners and flame safety devices require that the burner be at high fire for a minimum amount of time before returning to low fire. This parameter will set the minimum amount of time in seconds that burner must remain at high fire before the burner can turn off (or return to low fire).

Control Output (%)
The control output in the temperature setup panel is the same as the %output as detailed on the temperature detail panel on the main screen. The value is READ ONLY when temperature PID control is in AUTO mode. However, the %Output can be changed when PID is in MANUAL mode.

Control PID Values
PID settings can vary widely depending on the controller hardware incorporated with the system. If not familiar with the controller setup parameters for that hardware, contact Atmosphere Engineering for advice regarding initial settings and tuning recommendations.

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PRESSURE SETUP PARAMETER GROUP *(USER, ADMIN, ENG Levels)*
(OPTIONAL FEATURE)
This parameter group is only available when pressure control is enabled from the system setup screen. The pressure control feature can only be used on "LP Configuration" systems that utilize Variable Frequency blower motor controls. Changes to these parameters will take effect immediately. All parameters are only editable in USER, ADMIN, and ENG levels.

Pressure Setpoint
The pressure setpoint is the desired generator outlet pressure the system should maintain

Pressure Deviation Alarm / Delay
The deviation alarm value determines when a pressure deviation alarm should be triggered.

Control Gain
The control gain defines how fast the system responds to deviations from setpoint. A larger gain value will force the system to respond faster, however, if the gain is too large the system may become unstable and cause pressure fluctuations.

Control Rate
The control rate defines how quickly to make changes. A larger rate will slow down the iterations of the control loop but may make the system to slow to respond to pressure changes.

BURNOUT SETUP PARAMETER GROUP *(USER, ADMIN, ENG Levels)*
(OPTIONAL FEATURE)
This parameter group is only available when retort burnout control is enabled from the system setup screen. The retort burnout control feature can only be used on PLC control systems that have been programmed to interact with specific generator burnout air components. Changes to these parameters will take effect immediately. All parameters are only editable in USER, ADMIN, and ENG levels.

Burnout Start Buttons
The burnout start button will set the appropriate retort temperature to 1500degF and wait for the temperature to reach this setpoint before energizing the retort 1 burnout relay.

Burnout Stop Buttons
The burnout stop button will halt the retort burnout process for the retort. If the burnout relay for that retort is energized, then the burnout relay will de-energize immediately. No changes will be made to temperature setpoint for that retort.

Burnout Time (min)
The burnout time is the amount of time to energize the retort burnout relay for that retort. It should be noted that the burnout time and relay will stop if the temperature rises by more than 50deg above setpoint.

Burnout Status Messages
"Burnout Pending" – Burnout has been started but the temperature is not within 50deg of setpoint
"Burnout Active" – Burnout relay is energized and timer is counting.. remaining time is displayed with this message.
"Burnout Complete" – Indicates that the burnout timer has completed normally and that the relay has been de-energized.
"Burnout Stopped" – Indicates that the burnout was manually interrupted and that the relay is de-energized.

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LANGUAGE SETUP PARAMETER GROUP *(USER, ADMIN, ENG Levels)*

The EndoV5 HMI software is designed to be completely multi-language capable and can be changed while online. To change the language, select the flag of the country and all text and alarm messages will be in the predominant language of that country. If the language (or flag) desired is not found, contact Atmosphere Engineering support team to request a language/flag addition to the HMI program.

Editing the HMI Text Tag File

All displayed text on the HMI is locally stored as "tags" in the file "setup/ENDOV5tags" text lookup file. However, it is STRONGLY recommended not to edit this file directly using a text editor. Instead, it is recommended to use the "ENDOV5tags_Master Excel File" located in the same directory to edit any tags and use the procedure outlined here to update the ENDOV5tag file.

1. Using MS Excel, open the "ENDOV5tags_Master Excel File" located in the setup directory.
2. Edit the text as desired for the language selection desired
   Note: The first 2 columns indicate the tag number and brief usage description for the tag and each column afterwards contains the text for each specific language.
3. Save the changes to the "ENDOV5tags_Master Excel File"
4. Now, while still in the excel program, press "CTRL+A" to select all items
5. Press "CTRL+C" to copy all items in the Excel sheet.
6. Open "ENDOV5tags.txt" file located in the setup directory using notepad program or similar.
7. Press "CTRL+A" to select all items in the text file.
8. Press "CTRL+V" to paste all items from the excel file into the text file.
9. Save revised ENDOV5tags file (Note: filename cannot be changed).

Finding Which Tag to Edit

If unsure which tag number is used for a specific item on the HMI, double tap on the main title of the HMI (always located at the top left of the screen) and this will change the HMI screen so that it displays the tag number for each text item on the screen. To revert back to the language selection, double tap on the main title again.

Note: If the screen is using a language other than English, double tapping on the main title will convert the screen to English first, another double tap on the main title will convert the text to tag number assignments, and a final double tap will convert the screen back to the previously displayed language.

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SYSTEM SETUP PARAMETER GROUP *(ADMIN, ENG Levels Only)*
The EndoV5 HMI software has been designed to work with many different controllers and generator configurations. Parameters contained within the "System Setup" group are items that usually are only setup once during system installation and should not require frequent changes. It should be understood that parameters contained within the "System Setup" group can directly affect the safety of the generator. Only persons trained and experienced with generator setup and operation should attempt to change these parameters without direct support from Atmosphere Engineering.

System Signal Overview *(ADMIN, ENG Levels Only)*
The signal overview is a direct reading of the analog signals connected to the controller. It is primarily used for troubleshooting wiring and setup issues.

System Communication Setup *(ENG Level Only)*
This section contains parameters that affect how the HMI will communicate with the control device(s).

Controller Type
Select the modbus register lookup table to use with the installed controller. This parameter should only be changed with the support of Atmosphere Engineering.

HMI Comm Protocol *(Serial, TCP, or DEMO mode)*
Select the communication link type between the HMI and controller device. Demo mode will provide a demonstration mode that simulates values for training and presentation purposes.

HMI Serial Port *(Serial protocol only)*
Select the serial com port used to connect the HMI to the controller device.

HMI Baud Rate *(9600, 19200) (Serial protocol only)*
Select the serial baud rate used to communicate to the controller device.

HMI Parity *(Even, Odd, None) (Serial protocol only)*
Select the serial parity used to communicate to the controller device.

Device IP *(TCP protocol only)*
Enter the IP address of the controller device.

Enable Animation
Toggle if the screen uses animations. Turning animations off can make slow HMI screens more responsive.

Display Generator Screen
Toggle if the if the HMI should allow a visual representation of the generator. Some controller types do not provide adequate feedback from generator sensors and devices and therefore, this screen can be hidden to avoid confusion over component status.

Display Retort Number
Identify the number of retorts to display on the generator overview screen. Note: this parameter will be over written by the temperature loops active if a suitable graphic is not available to represent the temp loop and retort combination.

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System Device Setup *(ENG Level Only)*
This section contains parameters that define setup items specifically involved in how the HMI and Device are used with the generator equipment.

Device#1 Temp Unit
Informs the HMI of what temperature units are used within the controller device. This parameter MUST equal the temperature units within the control device. Note: changing this parameter does not change the units within the control device only how the HMI interacts with the controller.

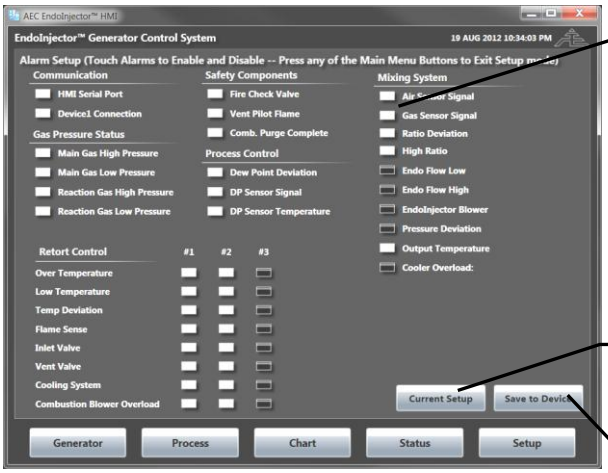
Device#1 DP Unit
Informs the HMI of what dew point units are used within the controller device. This parameter MUST equal the dewpoint units within the control device. Note: changing this parameter does not change the units within the control device only how the HMI interacts with the controller.

Device#1 Flow Unit
Informs the HMI of what flow units are used within the controller device. This parameter MUST equal the flow units within the control device. Note: changing this parameter does not change the units within the control device only how the HMI interacts with the controller.

Device#1 Press Unit
Informs the HMI of what pressure units are used within the controller device. This parameter MUST equal the pressure units within the control device. Note: changing this parameter does not change the units within the control device only how the HMI interacts with the controller.

Retort Burnout Enable
Informs the HMI if retort burnout capabilities are available within the connected controller. This parameter MUST equal the status of retort burnout capability within the controller. Note: changing this parameter enable burnout capability within the control device it only enables the burnout features on the HMI.

Device Alarm Setup (CAUTION!!!)
This is used to setup what alarms are enabled or disabled in both the HMI AND THE CONTROLLER. Note: Changing alarm enable/disable status actually changes the usage of alarms in the controller. If an alarm is "disabled" it will both be hidden on the HMI and disabled in the controller. Alarms should only be disabled when the generator does not require the alarm, the installation does not provide the necessary input signals to the controller, or alternate safeties have been installed. Exercise caution when disabling any alarms. Some alarms are critical to the safe operation of the equipment and are required to meet NFPA86 guidelines. Alarms must only be disabled if alternate safety measures are installed separate from the EndoInjector control device.



Alarm Enable Status
White = Alarm Enabled
Black = Alarm Disabled
(Press Alarm LED to Change Enable Status)
Note
Changing alarm status does not change immediately in the controller. Changes must be saved to the control device using the "Save to Device" button.

Load Current Alarm Setup from Controller

Save Alarm Setup to Controller

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System Flow Setup *(ADMIN, ENG Level Only)*
This section contains parameters that define setup items specifically involved in the flow control sensor for the EndoInjector™ and flow display on the HMI.

Flow Display Unit
Select what flow unit to display on the touchscreen. This does not change any parameters in the controller, only how the information is displayed on the HMI.

Air mA Offset
Offset the mA signal from the air flow transducer.

Gas mA Offset
Offset the mA signal from the gas flow transducer.

Endo Expansion Factor
Change the expansion factor used to calculate endothermic gas output flow rate. Endo Flow is a calculated value that represents the amount of endothermic gas being produced by the generator. It is calculated using the following equation: Endo Flow = (Air Flow + Gas Flow) x (Expansion Factor). Typical values for systems using natural gas = 1.43, and for systems using propane gas 1.52.

High Ratio Alarm Setpoint *(Default = 8.0 Nat Gas, 15.0 for Propane Systems)*
Define the maximum ratio limit that is considered safe. If the actual ratio is higher than this for longer than the high ratio alarm delay, then the critical alarm relay will be de-energized which should be interlocked to stop the mixing system. This is a test to ensure that gas supply is provided and the ratio control valve is functioning.

High Ratio Alarm Delay (sec) *(Default = 10 seconds)*
The high ratio alarm delay is the amount of time in seconds that a high ratio situation should be allowed to occur before triggering the critical alarm. Note: Depending on the reaction gas supply pipeline, there is typically a few seconds of time that the blower is started before gas is supplied to the mixing system. It may be necessary to increase this delay parameter to accommodate slower reaction gas introduction.

Valve Speed Gain *(FACTORY SET = DO NOT CHANGE THIS VALUE)*
This value defines the response characteristics of the fuel injection control valve. Typically, once this value is set at the factory, it will not require adjustment. Note: as a "rule of thumb" increasing this value will make the valve respond slower.

Low Flow Alarm
If the calculated endothermic gas flow rate is lower than this value for a time longer than the flow alarm delay time an alarm will sound.

High Flow Alarm
If the calculated endothermic gas flow rate is high than this value for a time longer than the flow alarm delay time an alarm will sound.

Flow Alarm Delay (sec)
The high/low flow alarm delay time.

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System DP Sensor Setup *(ADMIN, ENG Level Only)*
This section contains parameters that define setup items specifically involved in the setup of the dew point control for the EndoInjector™

DP Sensor Type *(Probe / Analyzer/ CO2)*
Select what sensor type will be used for measurement of the control variable. If CO2 is selected, the corresponding text will change for multiple fields.

DP Display Unit
Select what dew point unit to display on the touchscreen. This does not change any parameters in the controller, only how the information is displayed on the HMI.

Sensor TC Type *(Probe Only)*
Select what TC type is supplied with the probe.

H Factor *(Probe Only)*
The H Factor represents the presumed hydrogen amount contained in the endothermic gas. Typically, this value is set to 400 (representative of 40.0% hydrogen). The H Factor parameter is used to calibrate the dew point value calculation for zirconia oxygen sensors. Increasing the H Factor by 10 will cause approximately a 1degF offset in the dew point reading.

Sensor mV Offset
Offset the mV signal from the dew point sensor.

Sensor Temp Offset *(Probe Only)*
Offset the probe temperature signal.

CO2 Sensor Full Scale *(CO2 Only)*
Set the CO2 analyzer scale that is used to measure the control variable.

Probe Burnout Start *(Probe Only)*
Pressing this button will initiate a probe burnout immediately and will reset the probe burnout interval time.

Probe BO Interval (min) *(Probe Only)*
Time between each automatic probe burnout.

Probe BO Time (sec) *(Probe Only)*
Time to introduce burnout air to the probe.

Probe BO Delay (sec) *(Probe Only)*
Time to wait after stopping the burnout air before using the probe for automatic dew point control.

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System Temperature Setup *(ADMIN, ENG Level Only)*
This section contains parameters that define setup items specifically involved in the setup of the temperature control for the EndoInjector™

# of Temp Loops *(1, 2, or 3)*
Select how many active temperature control loops are on the generator.

Temp Display Unit
Select what temperature unit to display on the touchscreen. This does not change any parameters in the controller, only how the information is displayed on the HMI.

Temp TC Type
Select the TC type used for temperature control. All temperature loops must use the same TC type.

Temp#1 Offset
Offset the temperature signal for the first temperature control loop.

Temp#2 Offset
Offset the temperature signal for the second temperature control loop.

Temp#3 Offset
Offset the temperature signal for the third temperature control loop.

Burner Control Type (Premix, Ring, SCR)
Selection of the temperature control method used for the generator. This selection mainly affects the generator overview display regarding what pipeline diagram to display.

Purge Time (sec) *(Premix Control Type Only)*
Required amount of combustion air purge. Timer will start when the combustion air pressure switch is made. This option is only available when the combustion control type is set to "premix".

Endo Temp Enable
Select if the output endothermic gas temperature will be monitored.

Endo Temp Offset *(Endo Temp Enable = True)*
Offset the temperature signal for the endothermic gas thermocouple.

Endo Temp Alarm *(Endo Temp Enable = True)*
When the endothermic gas output temperature is above this setpoint an alarm will be triggered.

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System Pressure Setup *(ADMIN, ENG Level Only)*
This section contains parameters that define setup items specifically involved in the setup of the pressure control for the EndoInjector™. The pressure control is only available on the "LP" configuration systems that utilize a variable speed drive to control the speed of the EndoInjector™ blower.

Endo Pressure Sensor Enable
Indicate if a pressure sensor is attached to monitor the endothermic gas generator output pressure.

Endo Pressure Sensor Scale *(Endo Pressure Sensor Enabled)*
Set the pressure transducer scale that is used to measure the generator output pressure.

Endo Pressure Sensor mA Offset *(Endo Pressure Sensor Enabled)*
Input an offset for the endo gas pressure sensor mA signal (displayed on the signal overview screen).

Premix Pressure Sensor Enable
Indicate if a pressure sensor is attached to monitor the premix gas pressure.

Premix Pressure Sensor Scale *(Premix Pressure Sensor Enabled)*
Set the pressure transducer scale that is used to measure the generator output pressure.

Premix Pressure Sensor mA Offset *(Premix Pressure Sensor Enabled)*
Input an offset for the premix pressure sensor mA signal (displayed on the signal overview screen).

Pressure Display Unit *(Pressure Control Enabled)*
Select what pressure unit to display on the touchscreen. This does not change any parameters in the controller, only how the information is displayed on the HMI.

Pressure Control Enable *(Endo Pressure Sensor Enabled)*
Select if system pressure control should be enabled. Only if the system is provided with a VFD controller to change the speed of the pump.

Blower Min Hz *(Pressure Control Enabled)*
Set the minimum speed that the blower should be allowed to run. This setting is used to set a base minimum flow rate through the generator. This value should be set at the frequency where the output flow is approximately 25-30% of rated generator capacity. Therefore, if output demand is reduced further, then the system will not allow the blower to spin slower and the output pressure will rise allowing for a relief regulator to open. The setup should provide that the flow through the EndoInjector™ mixing system is not below 20% of rated capacity.
Note: It is not recommended to run the blower motor at frequencies lower than 20Hz due to higher amperage and heat generated at these lower speeds.

Blower Max Hz *(Pressure Control Enabled)*
Set the minimum speed that the blower should be allowed to run. The setting can set to the frequency that provides the maximum flow capacity of the generator. Thus if additional demand is required, the blower will not increase in speed further than this value so that the system does not produce more endothermic gas than the system was designed.

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System Calibration Curve Setup *(ENG Level Only)*

This section contains parameters that define the calibration curves for the air and gas flow transducers attached to the mixing system. DO NOT change these parameters without specific instruction from Atmosphere Engineering.

Air Curve Data

Indicate each calibration point for the air flow transducer (mA and Flow)

Gas Curve Data

Indicate each calibration point for the gas flow transducer (mA and Flow)

Selecting any button will allow the operator to edit the calibration curve mA or Flow for each calibration point.

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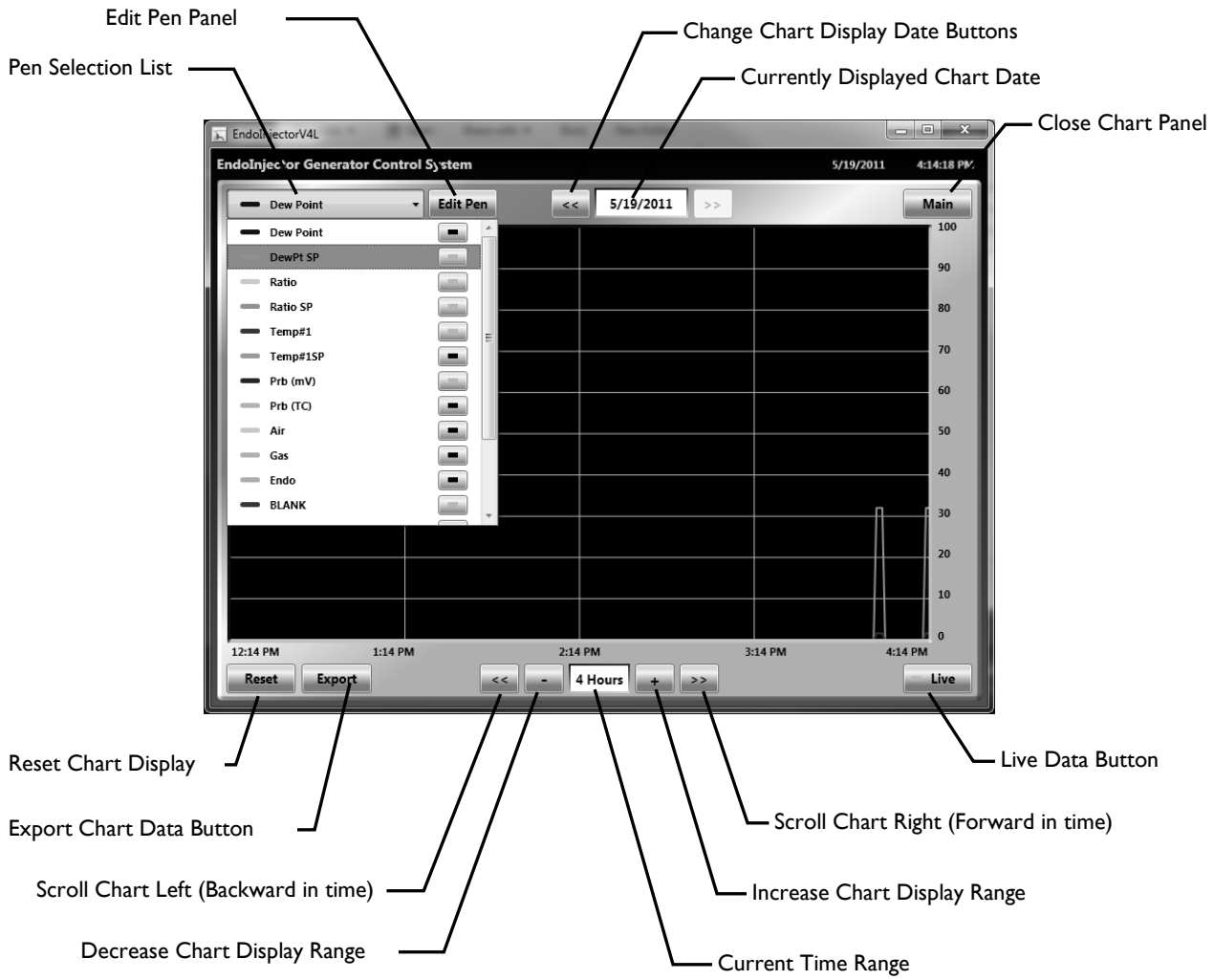
PAPERLESS CHART RECORDER

Pressing the "History" button on the main screen opens the EndoInjector paperless chart recorder. The paperless chart recorder displays the long term historical data for all generator process variables. Data is stored once every minute on the touch-screen hard drive in daily encrypted log files that can be exported to CSV files that can be opened in any spreadsheet program (i.e. MS Excel) for detailed investigation and reporting if required. The generator performance data will never overwrite old data since the hard drive space provides 50+ years worth of daily storage space. However, for tacking purposes, the data should only be considered archived for 5+ years on the touch screen unless backed up to a remotely maintained data storage center.

PAPERLESS CHART RECORDER OVERVIEW



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PAPERLESS CHART RECORDER

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PEN SELECTION LIST

The pen selection list provides a list of all pens available to display, the current pen color for each variable, and a button to display or hide the pen on the chart. Also, selecting a pen will update the scale values on the right of the chart to display the selected pen's scale settings. Each pen is drawn based on their own minimum and maximum scale range. The scale range for each pen can be changed by first selecting that pen in the Pen Selection List and then pressing the "Edit Pen" button. Note: The actual data values are stored regardless of pen scale or display settings.

Edit Pen Button

The edit pen button opens a panel that provides a way to edit the minimum display scale range, maximum display scale range, and pen color selection. Note that each pen is drawn based to it's own scale however, actual data stored is not affected by these settings.

Currently Displayed Chart Date

The log data is separated into daily log files. The log file that is currently being displayed is shown in the currently displayed chart date at the top of the chart.

Change Chart Display Date Buttons

The change chart display date buttons are located on either side of the current chart date at the top of the chart screen. Pressing these buttons will increase or decrease the current display date by one day.

Current Time Range

The current time range is found at the bottom of the chart display and represents the amount of time currently displayed from the left to the right on the chart. The default is to display 4 hours of data at a time but this can be increased to an entire day or decreased to just 15 minutes.

Increase / Decrease Chart Display Range Buttons (+ / -)

The increase and decrease chart display buttons will change the time range of data to display on the chart. Basically, these buttons provide a way to zoom in and out of the data in time. The limit is to increase the range to view an entire day of data or decrease the range to view just 15minutes of data.

Scroll Chart Right / Left (<< / >>)

The scroll chart buttons provide the means to pan the chart through time. Each press of either of these buttons will scroll the chart by 2 vertical gridlines (1/2 of the time range displayed).

Live Data Button

The live data button indicates and provides a way to turn the chart display on or off so that it automatically updates while viewing the data. When the live button is "on" then the chart will update and scroll automatically from right to left as new data is written to the log file.

Reset Chart Display

The reset chart display will reset the current display date to "today" and the current time range to 4 hours.

Export Data Button

The export data button opens a save dialog window to export the currently displayed daily data to a csv file. Attach a USB storage device to one of the USB ports on the back of the touch-screen then navigate and save the csv file to the storage device so that it can be transferred to another computer for review.

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ALARM STATUS SCREEN

Pressing the "Status" button on the main screen opens the alarm status screen that indicates current system alarm status. The visibility of some alarms depends on what alarms are enabled on the system and available on the controller installed. The lists of alarms will turn green, yellow, or red depending on status of the alarm being described.
Red = Active alarm that has not been acknowledged
Yellow = Active alarm that has been acknowledged
Green = Alarm is OK
Black = Alarm status is Unknown due to communication failure

Communication Alarm Status

COM alarms occur when any failure of the Modbus communication is detected. All other alarms will remain "Black" until all communication alarms are resolved as OK.

HMI Serial Port

A port open alarm occurs when the com port selected in the setup screen is not actually found on the HMI touch screen. Also, if the communication port of Ethernet is selected then a port alarm will occur when the IP address the HMI is trying to reach to communicate with the ratio controller is not found.

Device Connection

A ratio controller communication alarm occurs when the ratio controller cannot be found or a Modbus read or write operation has failed. Typically, this alarm will occur if the polarity of a serial connection is reversed or disconnected.

Gas Pressure Status

Main Gas High/Low Pressure

Indication that the high and low main gas pressure switches are ok.

Reaction Gas High/Low Pressure

Indication that the high and low reaction gas pressure switches are ok.

Safety Components Alarm Status

Fire Check Valve

Indication that the fire check valve switch is ok.

Vent Pilot Flame

Indication that the vent pilot flame safety is OK. This flame must be present during the mixing system operation.

Combustion Purge Complete

The combustion purge timer will begin timing when the combustion blower low pressure switch is made. The amount of time required is defined in the system setup menu. Once purged, the timer will reset when the combustion air low pressure switch falls open.

Process Control Alarm Status

Dew Point Deviation

Indication that dew point is outside the deviation band for more than the alarm delay period.

Dew Point Sensor Signal

Indication that the dew point signal is below 300mV or above 1249 mV.

Dew Point Sensor Temperature

Indication that the probe temperature is below 1100F or above 2000F

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Mixing System Alarm Status

Air / Gas Sensor Signal
Indication that air or gas sensor is outside normal 4-20mA range

Ratio Deviation
Indication that air/gas ratio is outside the deviation band for more than the alarm delay period.

High Ratio
Indication that air/gas ratio is above the high ratio alarm setpoint for more than the alarm delay period.

Endo Flow Low / High
Indication that calculated endo gas flow is below or above the alarm setpoint for more than the alarm delay period.

EndoInjector™ Blower
Indication that the blower is not in operation.

Pressure Deviation
Indication that pressure is outside the deviation band for more than the alarm delay period.

Output Temperature
Indication that endothermic gas temperature is above the endo temp alarm setpoint. This is an indication that the cooler may not be in operation or requires maintenance..

Combustion Blower Overload
Indication that combustion blower is not in operation due to motor amperage overload.

Retort(s) Alarm Status

Over Temperature
Indication that the over temperature controller for that retort is tripped open.

Low Temperature
Indication that temperature of the retort is below the low temperature alarm setpoint.

Temp Deviation
Indication that temperature of the retort is outside the deviation band for more than the alarm delay period.

Flame Sense
Indication that flame safety for the retort does not sense a flame or pilot flame present

Inlet Valve
Indication that inlet valve is open when the temperature is below the low temperature alarm setpoint.

Vent Valve
Indication that the outlet valve is not in the vent mode before system startup.

Cooling System
Indication that the cooling system for the retort is not operational.

Cooling System Overload
Indication that cooling system overload has been tripped.

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Maintenance

The LP EndoInjector™ is designed as a very robust industrial mixing system and the control logic is setup to monitor critical system faults before damage can occur. However, there are a few recommended items to check regularly on the mixing system to ensure successful system operation over many years.

Intake Air Filter

The intake air filter is the main item of concern that must be checked regularly and changed preemptively to ensure that the blower motor is not overheated or damaged. Atmosphere Engineering installs a filter change indicator next to the intake air filter that should be inspected weekly and when the filter change indicator reaches the "RED ZONE" then the filter element should be removed, blown off/cleaned, and then replaced. After resetting the filter change indicator, continue to watch the filter change indicator. If the filter change indicator reaches the "RED ZONE" again then the filter element should be changed. Filter change times will range between monthly to every 6 months depending on the air quality in the room where the EndoInjector is located. In some circumstances, it may be advisable to pipe the incoming air from a separate location.

NOTICE

Running the blower with the filter change indicator in the "RED ZONE" for an extended period can cause offset in flow transducer readings and will cause the blower to overheat and can cause damage to the blower bearings and motor.

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