

Product Guide Specification

Nexus Integrated Burner Control System

1. General

1.1 Overview

Each burner shall be equipped with a Micro-Processor Based Burner Management Flame Safeguard and Parallel Positioning Control System.

The control shall fully integrate the Flame Safeguard functions and Combustion Control functions into a single control module.

Specifically, the controller shall provide the following features and functions:-

- (1) Automatic sequencing of the burner through closed and open position proving employing both feed-back position proving and servo mounted end-stop switches. Pre-purge, ignition position, pilot trial for ignition (PTFI), main trial for ignition (MTFI), low-fire, run, and post purge shall be incorporated within the flame safeguard element within the control.
- (2) Flame proving and lockout on flame failure during PTFI, MTFI and run condition. The control shall utilize Fireeye flame scanners and be capable of interfacing with UV, UV Self Check and Infra Red Flame scanners via parameter selection.
- (3) Individual control of up to four servo positioning motors, two of which will be designated "AIR" servos and two of which will be designated "FUEL" servos.
- (4) Servo positioning motors operating at the same voltage as the controller and available in three torque ratings 3ft/lbs, 15ft/lbs and 37ft/lbs. In each case servo positioning motors to be directly connected to the controller and not driven by any interface relays.
- (5) Two separate and selectable PID loops to provide independent firing rate control of the burner based on set point and the process temperature (or pressure) input.
- (6) Two separate and selectable desired temperature (or pressure) set points to provide night set back based switching between desired temperature.
- (7) Gas pressure supervision.
- (8) Selectable main gas valve leak test detection and main valve proof of closure via Proof of Closure switch. These to be available to operate in parallel or individually by selection.
- (9) Steam pressure, water temperature and gas pressure sensors with full self checking capability. Any failure of the sensors shall be indicated as a fault and generate a dedicated lock out of the control
- (10) Multiple boiler/burner sequencing.

- (11) Current status and system diagnostics via controller mounted LED's and panel mounted alpha-numeric display.
- (12) Remote communications capability using Windows based software.
- (13) Multi function expansion interface capability providing O2 Trim, variable speed drive, two sets of analogue inputs and outputs and an additional servo drive capability
- (14) O2 Trim capability utilizing zirconium oxide "in situ" fast response probe
- (15) Fully automatic (one key press), automatic trim commissioning capability. The automatic trim commissioning to self calibrate the control to provide selectable trim correction up to a maximum of 25%
- (16) Trim correction capability based on adjustments characterized to fuel / air flow and not damper position.
- (17) Parameter selectable Trim correction capability, for fuel or air trimming
- (18) Applied Trim action capability, continuously displayed as a plus or minus percentage
- (19) Variable speed drive capability based on analogue command signal and analogue response signal safety monitoring. This shall be fully adjustable moving in conjunction with the servo drives.
- (20) Capability to display up to four system variables as 4 to 20 mA analogue signals and to zero, span and alarm limit each one.
- (21) Capability to receive and display as inputs, up to four external signals as 4 to 20 mA analogue signals and to zero, span and alarm limit each one.
- (22) Capability to drive one additional servo positioning motor of the same type and specification as detailed in (3) and (4).

Two separate fuel - air ratio profiles shall be provided for **each** fuel, selectable through a digital input. The Profile set-points shall be configurable allowing up to 20 set-points per profile in addition to those points used for Closed, Open, Ignition (Preferred Start) and Low Fire. The profile set-points shall be entered from the low fire position to the high fire position to avoid overheating or loading of the boiler. Once a minimum of four set-points have been entered the controller shall be capable of running the burner automatically, allowing boil out or curing at low firing input.

Selected Option Parameters such as Setpoint Control Value, PID terms and motor travel speed adjustments shall be available while the burner is firing for tuning purposes. Access to adjustments of safety timings & functions shall be prevented unless the burner is off. In any event passcode protection will be provided for all set-points for three individual category levels.

1.1.1 The Control System shall be supplied by Fireye.

1.2 Codes and Standards

The Control shall be listed by Underwriters Laboratories carrying US and C designations for UL 372 Primary Safety Controls for Gas and Oil Fired

Appliances. Where necessary it shall bear the CE marking designating that it is classified in accordance with EN298:

2.0 System Hardware

2.1 Controller

- 2.1.1 The controller shall provide individual outputs for Burner Motor, Ignition, Pilot Valve, Gas Valve 1, Gas Valve 2, Oil Valve, Vent Valve, and Auxiliary Relay. These outputs shall be rated at 2A rms (pilot duty) / 4A rms (power factor > 0.6).
- 2.1.2 The front panel of the Controller shall provide 8 LED's for indication of the sequence status. The LED's shall further provide diagnostics indication of any fault condition.
- 2.1.3 The controller shall further provide for 10 digital inputs which can be configured to select fuel type, re-set, or other designated uses. Five of these shall be isolated to provide safety critical functions.
- 2.1.4 Air pressure supervision shall be provided via a dedicated spdt input proving both flow and no-flow conditions.
- 2.1.5 Line voltage limits shall be connected to the controller via the burner select input providing on – off and limit control.
- 2.1.6 Two Form C Alarm Relay outputs shall be provided. One for limit alarms and the second for Safety related shutdowns. Relay contacts shall be rated for 2A rms (pilot duty) / 4A rms (power factor >0.6).
- 2.1.7 Four individual AC up/down Servo Motor outputs shall be provided.
- 2.1.8 Four individual feedback potentiometer supply outputs shall be provided.
- 2.1.9 The Controller shall be a plug in type to mount to a wiring base and be secured with two mounting screws.

2.2 Display

- 2.2.1 The Display shall provide full text messaging and access to the Profile and Option Parameter Set-points.
- 2.2.2 An Engineer's Key shall be provided to allow access to the systems internal variables, external input and output states and fault subsets.
- 2.2.3 The Display shall be cabinet mounted using the bezel assembly and housing provided with the display.

2.3 Sensors

- 2.3.1 Fail safe pressure sensor shall be provided for Steam Pressure indication and control. The Pressure Sensor shall be Fireeye Model NX1025 for 0-28PSI or NX1030 for 0 –375 PSI sensing range.
- 2.3.2 Fail Safe Temperature sensor shall be provided for Boiler Water Temperature indication and control. The Temperature sensor shall be Fireeye model NX1040 32°– 662° F sensing range.
- 2.3.3 Fail safe Gas Pressure Sensor shall be provided for gas pressure supervision. The Gas Pressure Sensor shall be Fireeye Model NX1020 0 – 4.5 PS1 sensing range.

2.4 Servo Motors

- 2.4.1 Individual Servo Motors shall be supplied for each of the controlled elements, Air #1, Air #2, Fuel #1 (Gas), Fuel #2 (Oil). These shall be Fireeye model NX-04 (3 ft/lb) NX-20 (15 ft/lb) or NX-50 37 ft/lb).
- 2.4.2 Position proving shall be provided through the drive shaft mounted feedback potentiometer.
- 2.4.3 Verification of correct motor positioning shall be provided by the use of end stop switches supplied on the servo motor. All servo motors for the selected fuel profile shall be exercised during the purge sequence prior to every burner start.

2.5 Wiring Base

- 2.5.1 The wiring base shall provide individual terminal connections for the various inputs and outputs.
- 2.5.2 The wiring base shall further provide Option Links which will allow selection of the supply voltage, sensor input, feedback pot and serial communications termination link.
- 2.5.3 The corners of the wiring base shall include cable clamps which will provide grounding for the cable shields.

2.6 Expansion Interface

- 2.6.1 The expansion interface shall provide individual terminal connections for the various inputs and outputs.
- 2.6.2 The expansion interface shall further provide power source and connections for dedicated zirconium oxide in situ probe.
- 2.6.3 The expansion interface shall further provide analogue input and output capability for control of a variable speed drives.
- 2.6.4 The expansion interface shall further provide analogue input and output capability for input of external analogue signals and transmission of system variables.

2.6.5 The expansion interface shall further provide connections for an additional servo positioning motor.

2.7 O2 Trim Analyzer

- 2.7.1 The O2 values utilized for trim shall be measured by an In Situ exhaust gas probe. This shall be a zirconium oxide device
- 2.7.2 Reaction time of the O2 trim to changes in O2 level (measured at the device) shall be not greater than 5 seconds
- 2.7.3 The O2 Trim Analyzer shall measure and display via the controller display, wet O2, dry CO2, exhaust temperature, combustion efficiency and applied trim action.
- 2.7.4 To maximize reliability, the O2 Analyzer shall have no moving parts, pumps or sample lines.