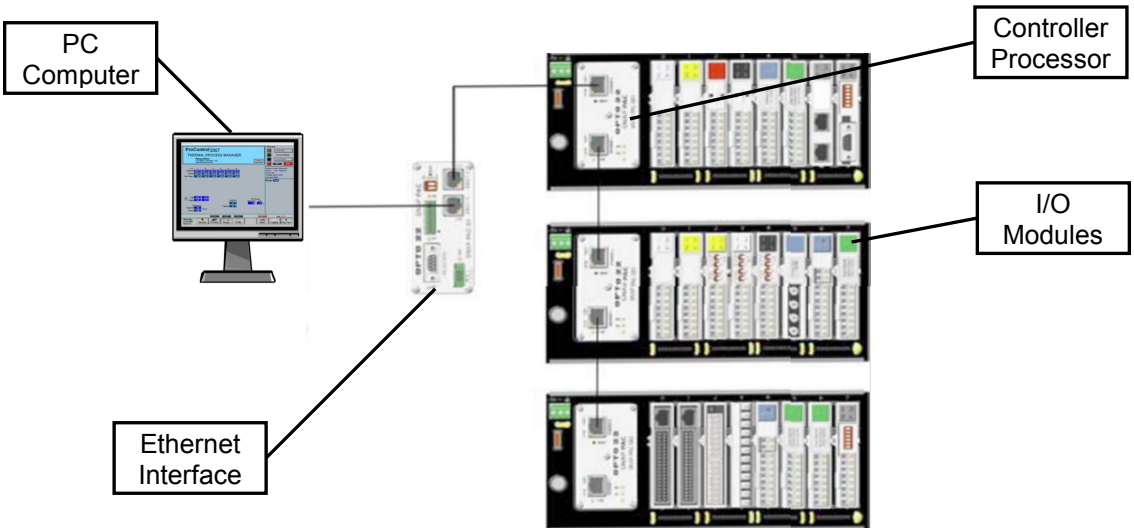
6 Controller

6.1 Conceptual Overview

An industrial controller is installed to organize signals throughout the furnace and relay information to the interface PC. The controller is the communication center for all furnace operations. Analog and digital relays provide sensory and feedback information via I/O modules to the controller which then regulates power, changes settings and sounds alarms.

Figure 6-1: Controller Overview



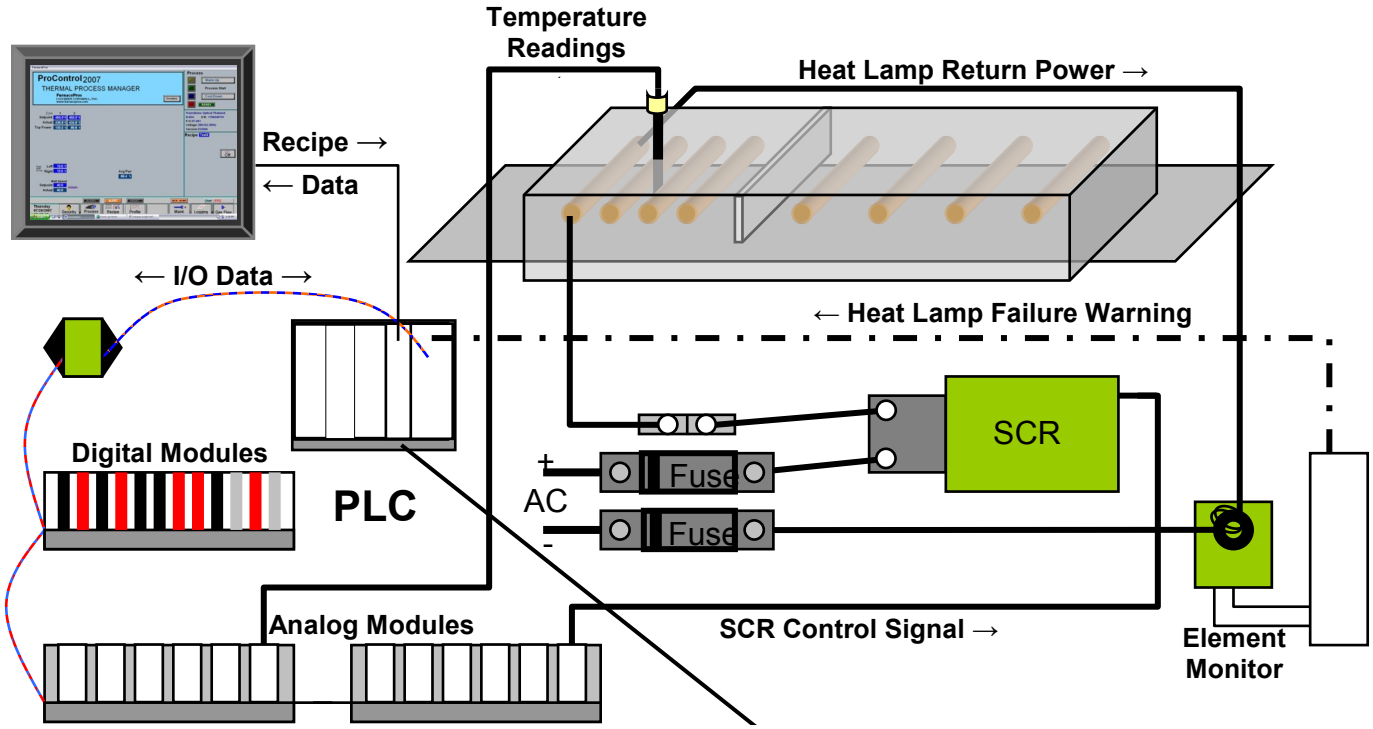
6.2 Terminology

6.2.1 PLC

The furnace controller is a industrial programmable logic controller or PLC. The software logic that the controller employs is downloaded from the PC to the controller memory. The PLC receives data from the furnace, sends information to the PC and controls the furnace. Thermocouple sensors and gas sensors are the main inputs to the PLC. The PLC controls the power the heat lamps and solenoid gas valves. In the event of an alarm, the controller will automatically shutdown the furnace based on the user programmed setpoints.

Industrial PLC

6.3 Data Flow

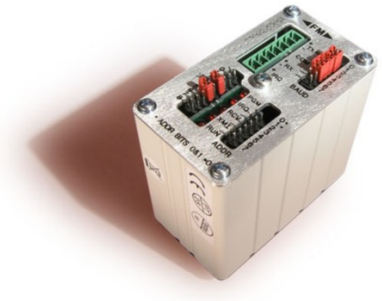

Temperature Readings
Heat Lamp Return Power →
Recipe →
← Data
← I/O Data →
← Heat Lamp Failure Warning
SCR
Digital Modules
PLC
+
AC
-
Fuse
Fuse
Analog Modules
SCR Control Signal →
Element Monitor

6.5 PLC Components

6.5.1 PLC CPU

The CPU is a high-performance processor used to remotely control analog and digital I/O modules. The CPU connects to the controller over an RS-485 serial link. CPU functions include PID loop control, latching, counting, totalizing, thermocouple linearization, and waveform generation.

The CPU is mounted on a rack with up to 8-16 analog, digital, and serial I/O modules.



PLC CPU
322-094410-01

6.5.2 PLC Power Supply

The power supply (120 VAC input) can provide 5 VDC power for loads up to 4 amps. This compact, sturdy supply includes a built-in fuse, an LED status indicator, and an ON/OFF power switch for ease of use.

The SNAP-PS5 provides 5 VDC power for a SNAP PAC rack with an I/O processor and I/O modules mounted on the rack.

PLC Power Supply
322-094408-01

6.5.3 PLC Communication

The LCM4 is a powerful industrial controller that provides real-time control and communication to input/output (I/O) systems, serial devices, motion controllers, and networks.

LCM4 Controller
322-092246-03

6.5.4 Ethernet Interface

The Ethernet Module provides an Ethernet interface for the LCM4 Controller. Connection is via a 10Base-T or 100Base-TX link, and standard TCP/IP transport is used for all transactions between the furnace Computer and the PLC Controller.

Ethernet Module
322-092246-04

6.5.5 PLC I/O

Furnace devices communicate analog and digital signals with PLC Controller input and output or I/O modules. Input modules receive furnace status data from sensors. The controller sends signals to the furnace via output modules to control furnace operation and provide audible and visual alarm indication.

Analog In Thermocouple Module
PN 322-094405-01

Analog In

Specially calibrated analog input modules accept analog temperature input from type K thermocouples mounted in the chambers and furnace cabinet.

Analog Out Module
PN 322-094402-01

Analog Out

Analog output modules provide analog voltage signals to control power supplied to the heating elements, edge heaters (if supplied) and belt drive motor.

Digital In Module
PN 322-094406-01

Digital In

Digital In modules provide four channels of high-speed digital input. Each channel senses the on/off status for DC voltages from sources such as transport motion fault and belt speed feedback. Each module has removable top-mounted connectors for easy access to field wiring, as well as channel-specific LED's for convenient troubleshooting.

Digital AC Output Module
PN 322-094401-01

Digital Out – AC

Four channels of 12-250 VAC digital output are supplied from each Digital Out module, each switching a separate AC load including light tower lamps. AC outputs use zero voltage turn on and zero current turn off for transient-free switching. The module has removable top-mounted connectors to provide easy access to field wiring and features channel-specific LED's for troubleshooting.

Digital DC Output Module
PN 322-094412-01

Digital Out – DC

Digital Out modules supply four isolated channels of 5-60 VDC digital output, each switching a separate DC load such as the alarm horn. Each module features manual-on/manual-off/automatic switches that override output from the application and are ideal for testing field device wiring.

6.5.6 Channel Assignments

Standard channel assignments are listed in Figure 6-4 Typical Channel Assignments - Windows Environment. This listing shows the assignment, channel number and function of the PLC inputs and outputs (I/O). See the Owner's Manual Drawings section for the as delivered equipment settings.

FURNACEPROS
DIV LOCHABER CORNWALL

FurnacePros
675 N. Eckhoff St. Bldg. D
Orange, CA 92868

Furnace Channel Assignments

Customer: ****Customer****

LAYOUT

Addr	Power Supply	322-092210-01	Addr	Controller	322-092246-01
21	Analog1	322-092212-01		Analog1_Expansion	322-092226-01
22	Analog2	322-092212-01	1	Digital1	322-092213-01
32	EleMon1_01_TO_16	322-092226-02 322-092246-02	33	EleMon2_17_TO_32	322-092226-02

Factory Order: **326xx**
Date: **DD-Mmm-YY**
Model Number: **XX**
Serial Number: ******
Power: **480vac, 60hz**

Chn	Signal	Part Number	Module Description	Model Number	Signal Description
	Analog1				
0	TEMPERATURE_ZONE_1_K	322-092204-01	Type K analog input	G4AD8-K	KA103 Thermocouple Inputs TC1
1	TEMPERATURE_ZONE_2_K	322-092204-01	Type K analog input	G4AD8-K	KA203 Thermocouple Inputs TC2
2	TEMPERATURE_ZONE_3_K	322-092204-01	Type K analog input	G4AD8-K	KA303 Thermocouple Inputs TC3
3	TEMPERATURE_ZONE_4_K	322-092204-01	Type K analog input	G4AD8-K	KA403 Thermocouple Inputs TC4
4	TEMPERATURE_ZONE_5_K	322-092204-01	Type K analog input	G4AD8-K	KA503 Thermocouple Inputs TC5
5	TEMPERATURE_ZONE_6_K	322-092204-01	Type K analog input	G4AD8-K	KA603 Thermocouple Inputs TC6
6	ZONE_1_TOP	322-092201-01	Analog dc out 0-5v	G4AD4	KA100 Top SCR Signal Control
7	ZONE_1_BOTTOM	322-092201-01	Analog dc out 0-5v	G4AD4	KA101 Bot SCR Signal Control
8	ZONE_2_TOP	322-092201-01	Analog dc out 0-5v	G4AD4	KA200 Top SCR Signal Control
9	ZONE_2_BOTTOM	322-092201-01	Analog dc out 0-5v	G4AD4	KA201 Bot SCR Signal Control
10	ZONE_3_TOP	322-092201-01	Analog dc out 0-5v	G4AD4	KA300 Top SCR Signal Control
11	ZONE_3_BOTTOM	322-092201-01	Analog dc out 0-5v	G4AD4	KA301 Bot SCR Signal Control
12	ZONE_4_TOP	322-092201-01	Analog dc out 0-5v	G4AD4	KA400 Top SCR Signal Control
13	ZONE_4_BOTTOM	322-092201-01	Analog dc out 0-5v	G4AD4	KA401 Bot SCR Signal Control
14	ZONE_5_TOP	322-092201-01	Analog dc out 0-5v	G4AD4	KA500 Top SCR Signal Control
15	ZONE_5_BOTTOM	322-092201-01	Analog dc out 0-5v	G4AD4	KA501 Bot SCR Signal Control
	Analog2				
0	ZONE_6_TOP	322-092201-01	Analog dc out 0-5v	G4AD4	KA600 Top SCR Signal Control
1	ZONE_6_BOTTOM	322-092201-01	Analog dc out 0-5v	G4AD4	KA601 Bot SCR Signal Control
2	RIGHT_EDGE_HEAT1	322-092201-01	Analog dc out 0-5v	G4AD4	KA111 Edge Heat 1 Left SCR Signal Control
3	LEFT_EDGE_HEAT1	322-092201-01	Analog dc out 0-5v	G4AD4	KA112 Edge Heat 1 Right SCR Signal Control
4	BELT_SPEED_OUTPUT	322-092203-01	Analog Out 0-10vdc	G4AD5	KA2 Motor Speed Control Signal
5	CABINET_TEMP	322-092204-01	Type K analog input	G4AD8-K	KA1703 Cabinet Temperature input
6-15	Not Used				
	Digital1				
0	MAIN_POWER_LATCH	322-092200-01	Digital AC Out 12-140vac	G40AC5MA	K4 Delay Power OFF, Ref: 802-101770
1	LAMP_POWER_CTRL	322-092200-01	Digital AC Out 12-140vac	G40AC5MA	K7 Process Power On, Ref: 802-101770
2	SPEED_FEEDBACK	322-092207-01	Digital In 2.5-16v	G41IDC5K	K11 Transport Motor Tach Feedback, Ref: 802-101771
3	TRANSPORT_MOTION_FAULT	322-092207-01	Digital In 2.5-16v	G41IDC5K	K8 Transport Motion Sensor, Ref: 802-101771
4	ALARM_HORN	322-092227-01	Digital DC Out 5-60vdc	G40DC5MA	K14 Alarm Horn, Ref: 802-101772
5	PRES_SW_N2_MANIFOLD	322-092202-01	Digital input 2.5-28v	G41DC5D	K? N2 pres. Sensors
6	ENTRANCE_SENSOR_MIDDLE	322-092202-01	Digital input 2.5-28v	G41DC5D	K81 SMEMA Center Sensor Int. Ref: 802-101777
7	EXIT_SENSOR_MIDDLE	322-092202-01	Digital input 2.5-28v	G41DC5D	K84 SMEMA Center Sensor Exit Ref: 802-101777
8	FlowSwitchN2	322-092202-01	Digital input 2.5-28v	G41DC5D	N2 Flow Sensor
9	PrePurgeProcess	322-092227-01	Digital DC Out 5-60vdc	G40DC5MA	N2 Pre-Purge Process Active
10	DiffusionInterlockSwitch	322-092202-01	Digital input 2.5-28v	G41DC5D	Diffusion Interlock Input
11	OzoneFailSafeSwitch	322-092202-01	Digital input 2.5-28v	G41DC5D	Ozone Fail Input
12-15	Not Used	322-092227-01	Digital DC Out 5-60vdc	G40DC5MA	Spare Output
	EleMon1_01_TO_16				
0	EM01	322-092207-02	10-32 vac/vdc digital input	Snap-IDC5	-| Input 1 of 4, Elem. Mon Z1-1-T
1	EM02	322-092207-02	10-32 vac/vdc digital input	Snap-IDC5	| Input 2 of 4, Elem. Mon Z1-2-T
2	EM03	322-092207-02	10-32 vac/vdc digital input	Snap-IDC5	| Input 3 of 4, Elem. Mon Z1-1-B
3	EM04	322-092207-02	10-32 vac/vdc digital input	Snap-IDC5	-| Input 4 of 4, Elem. Mon Z1-2-B

Figure 6-4 Typical Channel Assignments - Windows Environment

Notes: