



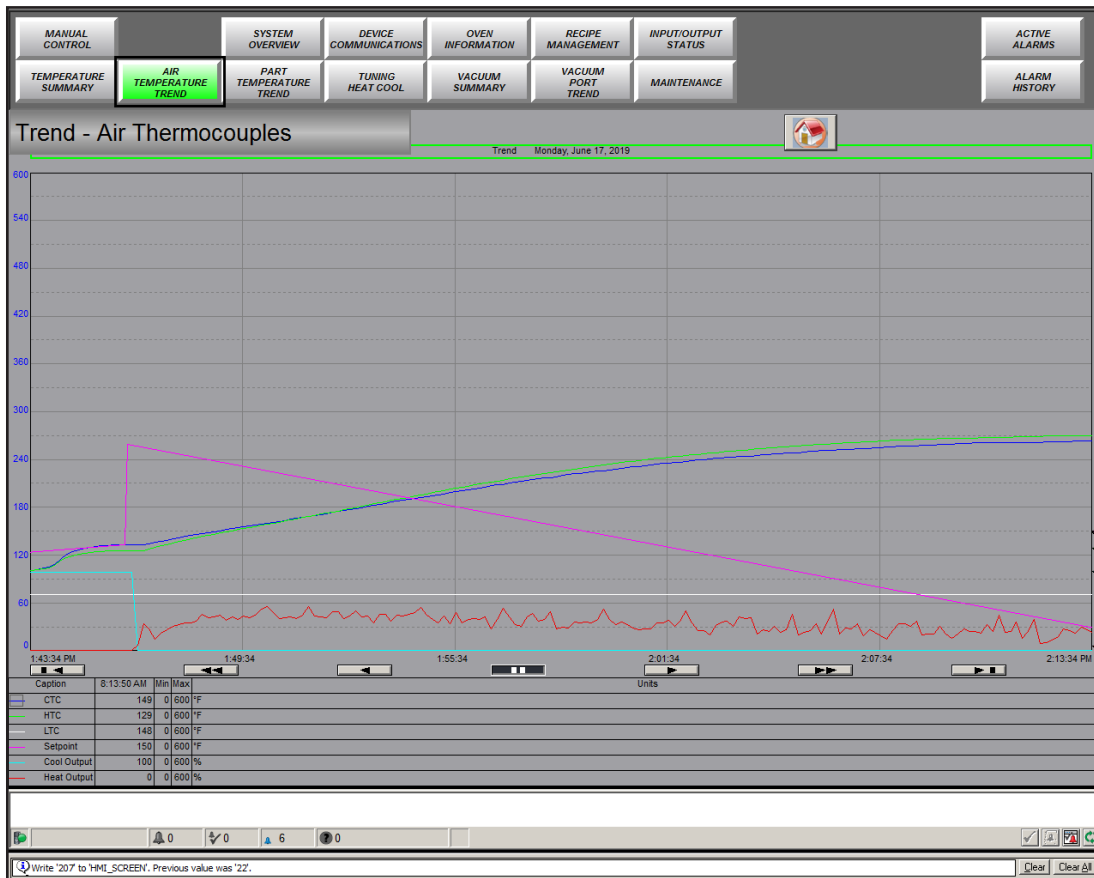
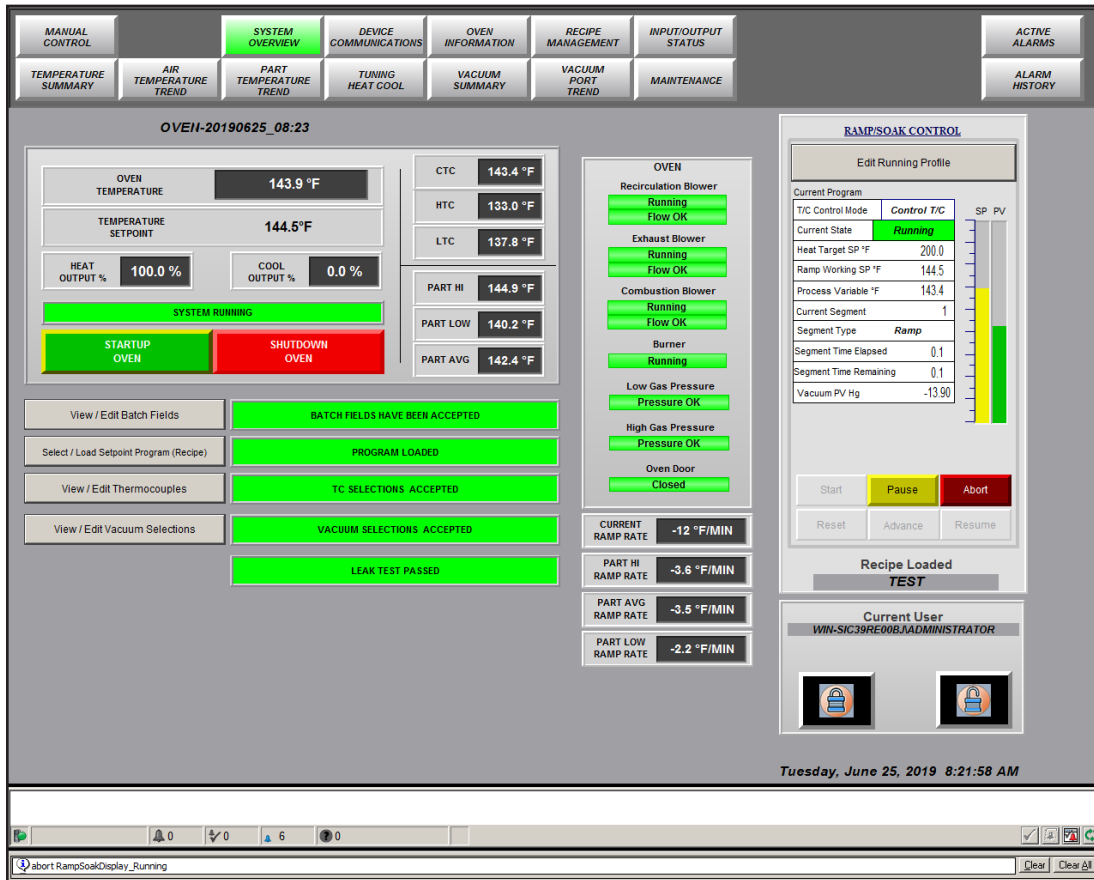
WISCONSIN OVEN CORPORATION



PREMIUM CONTROL SYSTEM

Data Acquisition and Control for Composite Curing







With the increasing use of composites in aerospace, transportation, medical, military, and other sectors, control systems play an ever more important role in optimizing the curing process. **Wisconsin Oven** meets this need with the **Wisconsin Oven Premium Control System (WPCS)**. The system offers high level monitoring and control of all the variables critical to consistent composite curing, and provides unsurpassed flexibility and reporting capability. The core of the system is a Rockwell-based PLC utilizing industry leading software for data archiving and reporting

With input from prominent aerospace manufacturers and many others, we designed the **Wisconsin Oven Premium Control System** specifically for composite processing. It provides the highest level monitoring of variables such as temperature and vacuum, and generates detailed, user-friendly reports that meet the requirements of AMS2750. It allows control based on air temperature or part temperature, with single, or multi-zone options available, and leading, lagging, and controlled ramping. WPCS features a very intuitive, user-friendly interface and powerful capabilities.

FEATURES:

- Versions for simple temperature control, multiple zone temperature control, single/multiple part temperature control, and peripheral control for items such as pressure, vacuum, blowers, doors, conveyors, etc
- Universal analog inputs accept T/C, RTD, Voltage, and Current Inputs
- Robust pseudo-integrating control. In the event of a CPU failure, the control loops continue to function, preventing loss of product
- Auto-Tuning and Overshoot Suppression features
- Thermal Overdrive feature to accelerate part heatup without overshoot
- Program Management features allow development and management of programs based on application
- Full featured Alarming, both Active and Historical, for all process items. E-mail Alarm Notification is available as well
- T/C status monitoring and automatic control T/C burnout switching
- On board data logging and archiving

Drawing on over 40 years of oven design expertise, and using best in class hardware, we created the **WPCS** to provide a turnkey solution that can be tailored to each specific application. The **WPCS** core control algorithm provides program control featuring time or rate based ramp/soak profiles, part based control capability (lead, lag, average, Overdrive), vacuum control, configurable step types, high/low deviation alarm set points, and thermocouple management.

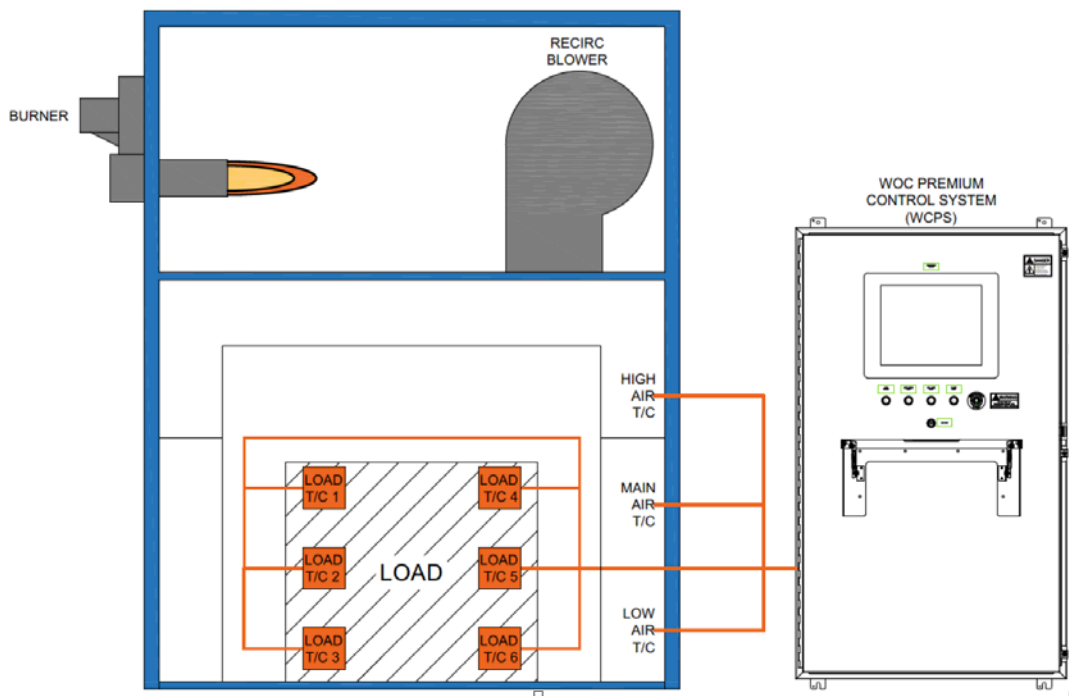
WPCS can control components and accessories such as:

- Recirculation Blower
- Exhaust Blower
- Vertical Lift Door
- Powered Load Cart
- Cooling Systems
- Vacuum pumps
- Other Special Equipment



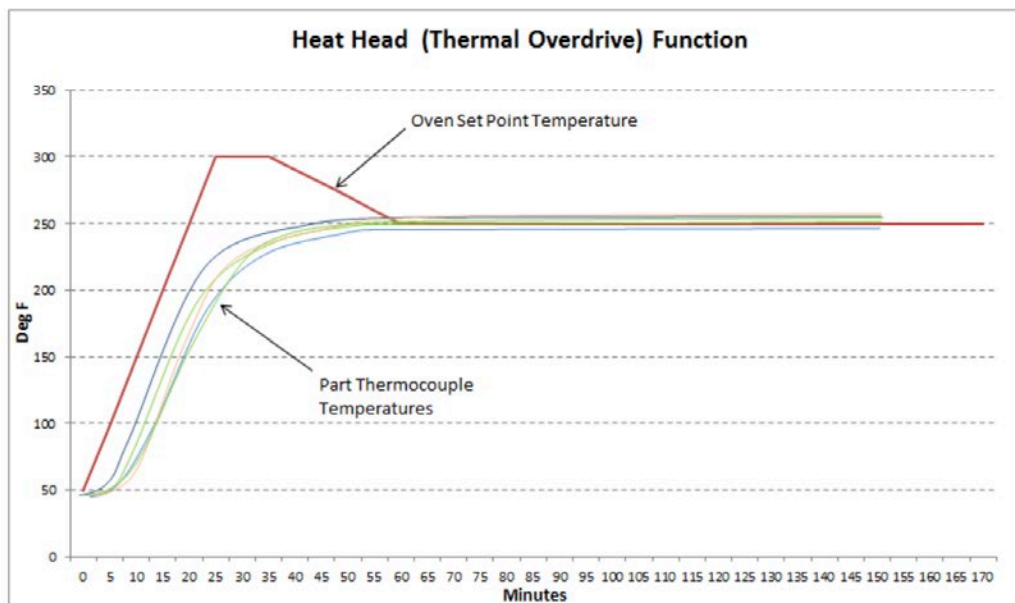
Control Based on Air or Product Temperature

Temperature is controlled via input from one or more thermocouples (TCs). The TCs can be located in the heated air stream or buried in the part, or both. Using leading, lagging, and averaging functions, along with thermal overdrive, the parts are heated evenly, and as quickly as possible, without overshoot. This also allows a guaranteed soak capability, where the soak time doesn't start until the part is up to the required curing temperature. The **WPCS** system can easily accommodate 100 or more TCs.



Thermal Overdrive

A common strategy to accelerate the curing cycle is to incorporate a controlled heat head, also known as thermal overdrive. This involves temporarily setting the oven recirculated air temperature above the desired target part temperature by a predetermined amount, which forces the part to heat more quickly than if the oven was set right at the desired part temperature. After the part temperature approaches the desired temperature, the **WPCS** automatically reduces the oven temperature to the desired part target temperature. This approach helps overcome the physical limitations of the part configuration to allow faster heating rates and increased production.





Vacuum Control and Monitoring

The **WPCS** uses vacuum transducers at each vacuum port to monitor and record the vacuum in real time. Prior to heating, the system checks the vacuum at each port for leaks, if required. Any leaking ports will be displayed and the operator must then either deselect the bad ports or fix the leaks and run the leak test until successful. Monitoring of the vacuum levels continues during the heating cycle, and low or high vacuum levels are reported. As an option, the system can be set up to provide different vacuum levels at each port, or a controlled vacuum level for a series of ports, which allows processing a wider variety of parts with fewer heating cycles.

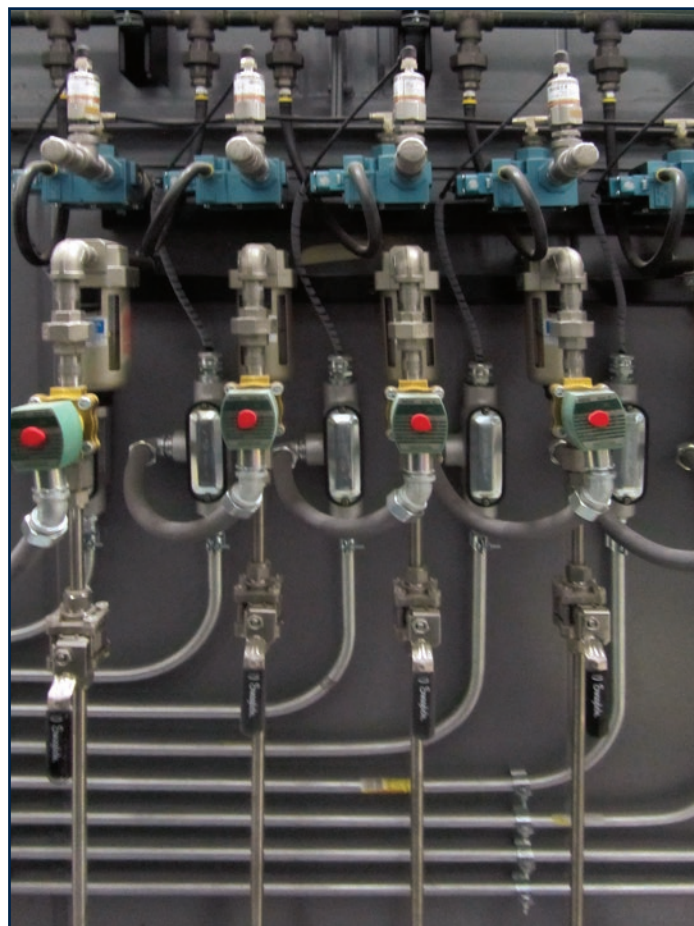
Data Recording

The **WPCS** is continuously logging data in the background during oven operation. When a batch is completed, **WPCS** queries the data for all information matching the Batch ID, including recipe information, interval thermocouple and vacuum readings, alarms, operation information and changes, and any other batch specific information. A batch report is then created that contains all information, as well as graphs and tables related to the run.

All data is logged to a database. During a batch run, **WPCS** logs all alarms, all thermocouple and vacuum readings, recipe name, recipe start/end date, min/max value during soak, any user configurable batch fields, and any changes to the process during a run. The time setting for the interval data can be user configured.

The batch report is generated on demand at batch completion or from the user portal. This allows the user to reprint the batch report even if the original is lost, as long as the data still resides in the database. This batch report is a complete record of the batch run, allowing easy analysis by production, quality, or engineering.

Batch reports can be configured at setup to meet specific user requirements. Feel free to contact us to discuss your exact reporting needs.



Alarm History

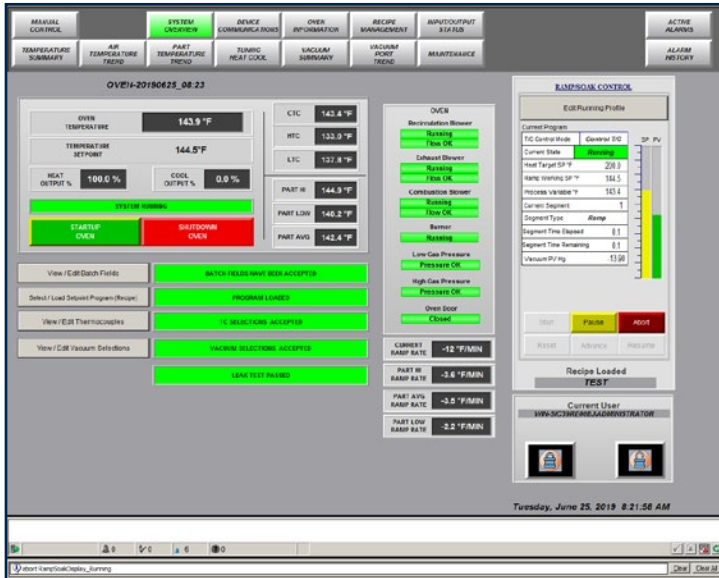
WPCS creates a record of equipment faults and alarms on the control system. Examples are system faults such as over temperature, blower failed to start, loss of gas pressure, etc. as well as process faults such as thermocouple burnout, vacuum out of range, temperature deviation alarm, etc.

Alarms are also recorded during a batch run for quality analysis.

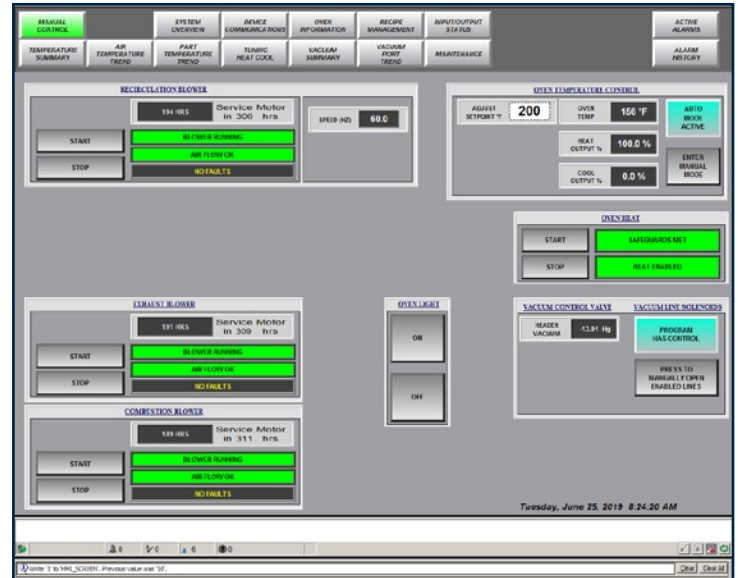
Current alarms can be viewed from the Active Alarm screen while historical alarms can be viewed from the Alarm History screen.

Intuitive Interface

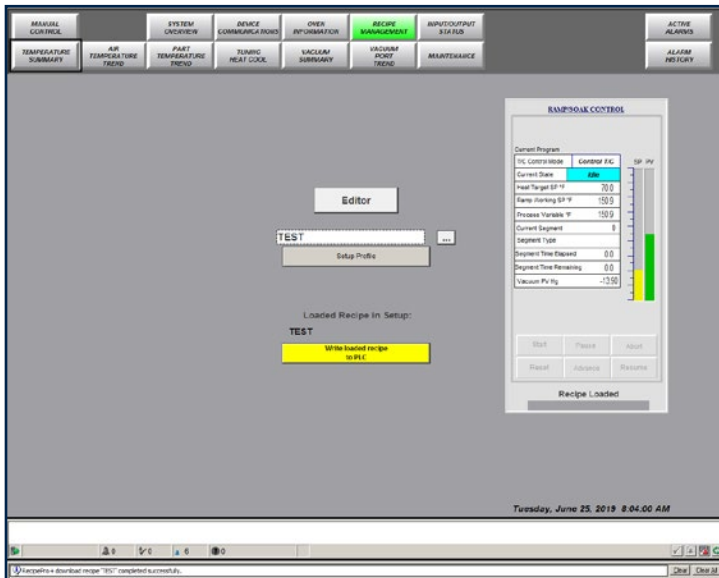
The **WPCS** is designed for ease of use, with intuitive screens and menu navigation. Our experience shows this is one of the keys to a successful implementation. Operators learn the system quickly, and management values the clearly written reports and data-management features.



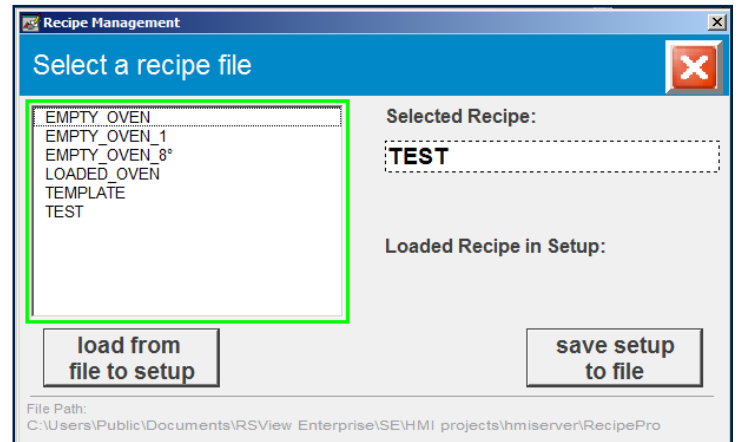
System Overview: Main operator screen that is used to automatically start/stop the oven. On this screen is the auto cycle start/stop, batch setup, recipe selection, oven blower/heat/door status, and user login.



Manual Control: Used to manually start/stop the oven. On this screen are the controls to start/stop the blowers, turn on/off the heat, and set up the oven temperature control, this screen can be used for troubleshooting oven operation.



Recipe Management: Used to load/edit/modify Recipes. The user can also Start/Pause/Abort a running recipe from this screen as well if all batch criteria have been met.



Recipe Select/Load: Used to load recipes to the PC for editing or running.

Setup Recipe

Loaded Recipe:

TEST

Time Base
Hours Minutes

4 Number of Ramp/Soak Stages Used
0.00 Acceptable Leak Rate Hg
☐ Leak Test Required

Segment Number 1

Soak	Timed Ramp	Guaranteed	Ramp Rate (deg / Minute)	Target °F	Guarantee Window °F (+/-)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	100.00	200.00	10.00

Input PV Selector

- Cooking Temp
- Air Temp High
- Air Temp Avg
- Air Temp Low
- Pant Temp High

Overdrive SP °F	Max Air Temp Alarm °F	Max Part Temp Alarm °F	Vacuum Alarm Hg	Deviation Timer (Mins)	Deviation Alarm °F	Recirc Blower Output %
0.00	0.00	0.00	0.00	0.00	0.00	100.00

Events (Outputs)

Vacuum	Auto Shutdown	Event 3 Spare	Event 4 Spare	Event 5 Spare	Event 6 Spare
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

write loaded recipe to PLC

save to loaded recipe file

Recipe Setup: Used to view and edit existing recipes.

RAMP/SOAK CONTROL

Edit Running Profile

Current Program

T/C Control Mode	Control T/C
Current State	Idle
Heat Target SP °F	70.0
Ramp Working SP °F	143.7
Process Variable °F	143.7
Current Segment	0
Segment Type	
Segment Time Elapsed	0.0
Segment Time Remaining	0.0
Vacuum PV Hg	-13.90

SP
PV

Start

Pause

Abort

Reset

Advance

Resume

Recipe Loaded

TEST

Ramp/Soak Control: Used to start/pause/advance/abort a recipe, view running recipe, and view running recipe status such as current set point, elapsed time, etc.

MANUAL CONTROL		SYSTEM OVERVIEW		SERVICE COMMUNICATIONS		OVER INFORMATION		RECIPE MANAGEMENT		INPUT/OUTPUT STATUS		ACTIVE ALARMS	
TEMPERATURE SUMMARY		AIR TEMPERATURE TREND		PART TEMPERATURE TREND		TUNING REACT LOGS		SACRAM SUMMARY		WARMUP POST TREND		ALARMS HISTORY	
CIC 147.7 °F CALIBRATION		HTC 126.0 °F CALIBRATION		LTC 146.5 °F CALIBRATION									
PART TC #1 139.5 °F CALIBRATION	PART TC #2 145.0 °F CALIBRATION	PART TC #3 141.8 °F CALIBRATION	PART TC #4 147.2 °F CALIBRATION	PART TC #5 0.0 °F CALIBRATION	PART TC #6 0.0 °F CALIBRATION	PART TC #7 0.0 °F CALIBRATION	PART TC #8 0.0 °F CALIBRATION	PART TC #9 0.0 °F CALIBRATION	PART TC #10 0.0 °F CALIBRATION	PART TC #11 0.0 °F CALIBRATION	PART TC #12 0.0 °F CALIBRATION	PART TC #13 0.0 °F CALIBRATION	PART TC #14 0.0 °F CALIBRATION
PART TC #5 0.0 °F CALIBRATION	PART TC #10 0.0 °F CALIBRATION	PART TC #15 0.0 °F CALIBRATION	PART TC #20 0.0 °F CALIBRATION	PART TC #25 0.0 °F CALIBRATION	PART TC #30 0.0 °F CALIBRATION	PART TC #35 0.0 °F CALIBRATION	PART TC #40 0.0 °F CALIBRATION	PART TC #45 0.0 °F CALIBRATION	PART TC #50 0.0 °F CALIBRATION	PART TC #55 0.0 °F CALIBRATION	PART TC #60 0.0 °F CALIBRATION	PART TC #65 0.0 °F CALIBRATION	PART TC #70 0.0 °F CALIBRATION
PART TC #17 0.0 °F CALIBRATION	PART TC #18 0.0 °F CALIBRATION	PART TC #19 0.0 °F CALIBRATION	PART TC #21 0.0 °F CALIBRATION	PART TC #22 0.0 °F CALIBRATION	PART TC #23 0.0 °F CALIBRATION	PART TC #24 0.0 °F CALIBRATION	PART TC #25 0.0 °F CALIBRATION	PART TC #26 0.0 °F CALIBRATION	PART TC #27 0.0 °F CALIBRATION	PART TC #28 0.0 °F CALIBRATION	PART TC #29 0.0 °F CALIBRATION	PART TC #31 0.0 °F CALIBRATION	PART TC #32 0.0 °F CALIBRATION
PART TC #30 0.0 °F CALIBRATION	PART TC #33 0.0 °F CALIBRATION	PART TC #36 0.0 °F CALIBRATION	PART TC #39 0.0 °F CALIBRATION	PART TC #42 0.0 °F CALIBRATION	PART TC #45 0.0 °F CALIBRATION	PART TC #48 0.0 °F CALIBRATION	PART TC #51 0.0 °F CALIBRATION	PART TC #54 0.0 °F CALIBRATION	PART TC #57 0.0 °F CALIBRATION	PART TC #60 0.0 °F CALIBRATION	PART TC #63 0.0 °F CALIBRATION	PART TC #66 0.0 °F CALIBRATION	PART TC #69 0.0 °F CALIBRATION
PART TC #73 0.0 °F CALIBRATION	PART TC #74 0.0 °F CALIBRATION	PART TC #75 0.0 °F CALIBRATION	PART TC #76 0.0 °F CALIBRATION										

RUN
AUTO SELECT
ACCEPT
TC SELECTIONS
DONE

Temperature Summary: Provides current thermocouple readings and is used to select/deselect thermocouples required for a recipe.

MANUAL CONTROL SYSTEM OVERVIEW SERVICE COMMUNICATION TOOLS OVER INFORMATION RECIPE MANAGEMENT INPUT/OUTPUT 0.14 FLB ACTIVE ALARMS

TEMPERATURE SUMMARY AIR TEMPERATURE TREND PART TEMPERATURE TREND VACUUM SUMMARY VACUUM PORT TREND MAINTENANCE ALARM HISTORY

VACUUM CONTROL MENU

HEALTHY VACUUM -13.68 Hg

PROGRAM HAS CONTROL

PRESS TO MANUALLY OPER DISABLED LINES

VACUUM LINE BOLTS/BORE

LEAK TEST PHASED

LEAK TEST VALUE OVER TIME (HRS)	LEAK TEST TIME (HRS)	ACCEPTABLE LEAK RATE Hg
1	1	0.000

PORTS

HEALTHY -13.01 Hg CALIBRATION Leakdown Rate 0.000	PORT 1 -13.76 Hg CALIBRATION Leakdown Rate 0.000	PORT 2 -13.28 Hg CALIBRATION Leakdown Rate 0.000	PORT 3 -14.14 Hg CALIBRATION Leakdown Rate 0.000	PORT 4 -13.87 Hg CALIBRATION Leakdown Rate 0.000
PORT 5 -13.35 Hg CALIBRATION Leakdown Rate 0.000	PORT 6 -13.95 Hg CALIBRATION Leakdown Rate 0.000	PORT 7 -13.83 Hg CALIBRATION Leakdown Rate 0.000	PORT 8 -13.87 Hg CALIBRATION Leakdown Rate 0.000	

RUN AUTO SELECT ACCEPT SELECTIONS RUN LEAK TEST DONE

Tuesday, June 25, 2019 8:18:56 AM

Vacuum Summary: Provides current vacuum reading and is used to select/deselect vacuum ports required for a recipe as well as perform a leak test.



CTC Calibration

ADJUSTED TEMPERATURE: **CTC 164.2 °F**

RAW TEMPERATURE: **161.8 °F**

FIXED BIAS / OFFSET °F: **0.00**

LIST CALIBRATION TEMPERATURES FROM LOWEST TO HIGHEST. IF THERE ARE LESS THAN FIVE POINTS, COPY THE INFORMATION FROM THE HIGHEST POINT INTO THE REMAINING CELLS.

CALIBRATION TEMPERATURE °F	INSTRUMENT CORR FACTOR °F	SENSOR CORR FACTOR °F	TOTAL CORR FACTOR °F
#1: 150.0	03.00	00.20	3.20
#2: 250.0	-2.00	-0.20	-2.20
#3: 350.0	-2.50	-0.90	-3.40
#4: 450.0	-1.50	-1.60	-3.10
#5: 450.0	-1.50	-1.60	-3.10

COMPLETE CALIBRATION **CANCEL CALIBRATION**

Thermocouple Calibration: Used to calibrate thermocouple correction factors and/or offset.

HEADER Calibration

ADJUSTED VACUUM: **HEADER 0.014 Hg**

RAW VACUUM: **0.014 Hg**

LEAK RATE: **0.000 Hg**

FIXED BIAS / OFFSET Hg: **0.000**

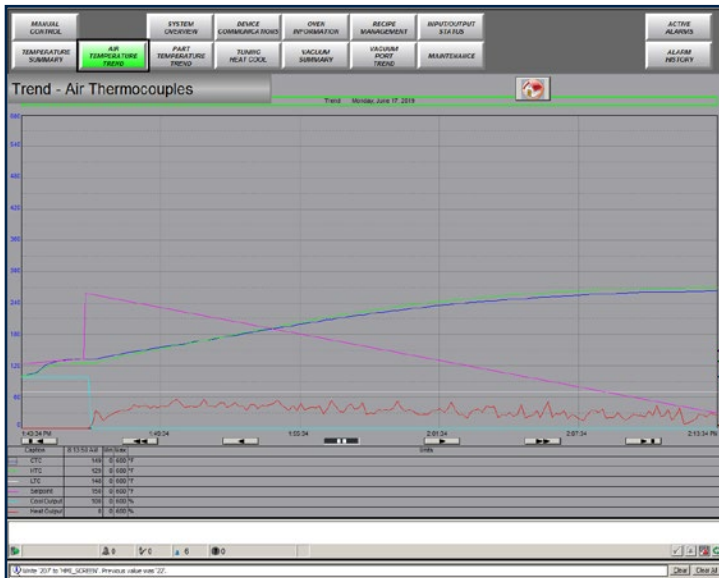
LIST CALIBRATION VACUUM FROM LARGEST NEGATIVE TO LOWEST NEGATIVE. IF THERE ARE LESS THAN FIVE POINTS COPY THE INFORMATION FROM THE LARGEST NEGATIVE INTO THE REMAINING CELLS.

CALIBRATION VACUUM Hg	INSTRUMENT CORR FACTOR Hg	SENSOR CORR FACTOR Hg	TOTAL CORR FACTOR Hg
#1: -0.900	0.000	0.000	0.000
#2: -0.800	0.000	0.000	0.000
#3: -0.700	0.000	0.000	0.000
#4: -0.600	0.000	0.000	0.000
#5: -0.500	0.000	0.000	0.000

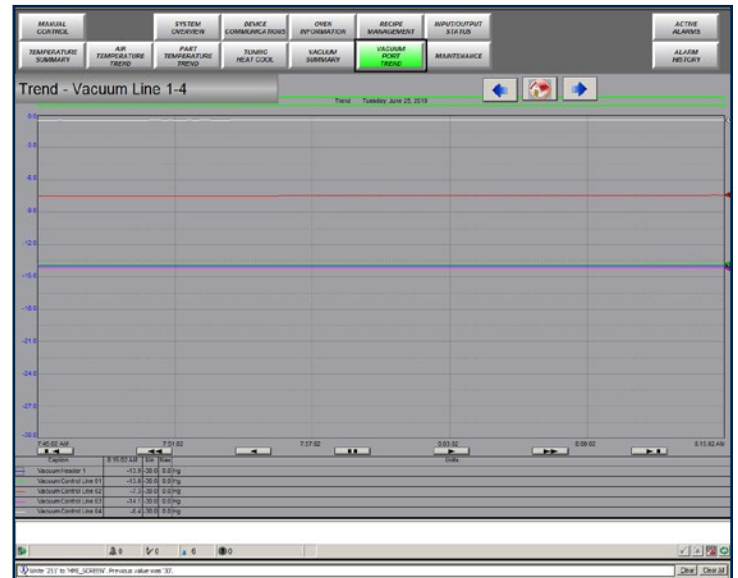
Calibration Enable: ☒ 1

COMPLETE CALIBRATION **CANCEL CALIBRATION**

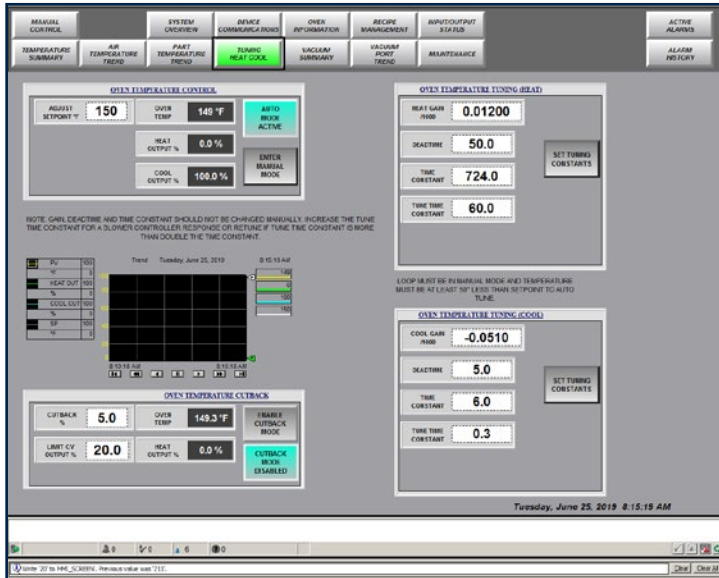
Vacuum Calibration: Used to calibrate vacuum correction factors and/or offset.



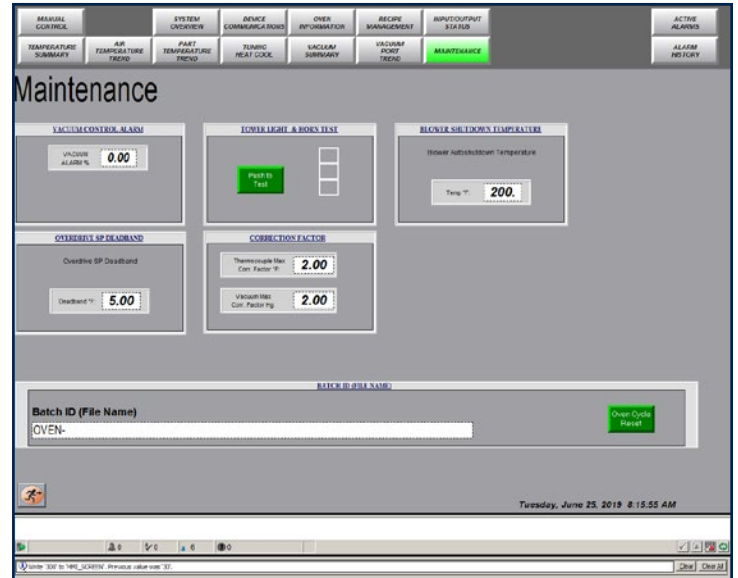
Temperature Trend: Displays the current trend of the connected thermocouples. The user can use the keys at the bottom of the screen to review previously collected data.



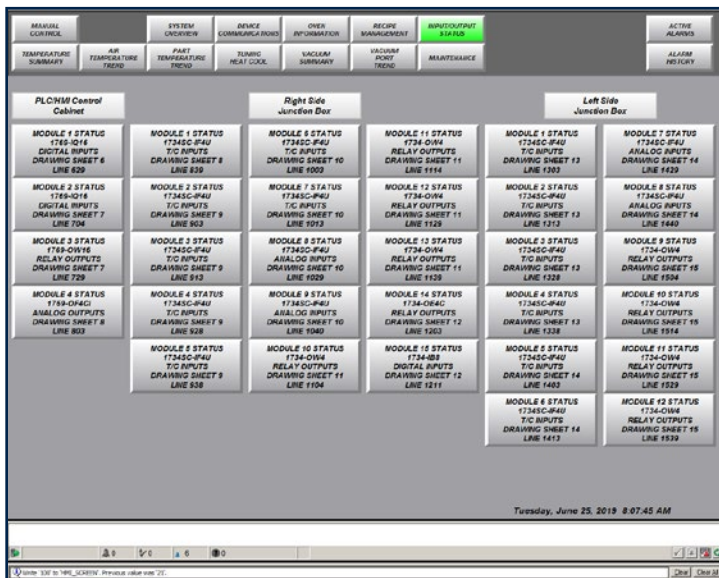
Vacuum Trend: Displays the current trend of the enabled vacuum ports. The user can use the keys at the bottom of the screen to review previously collected data.



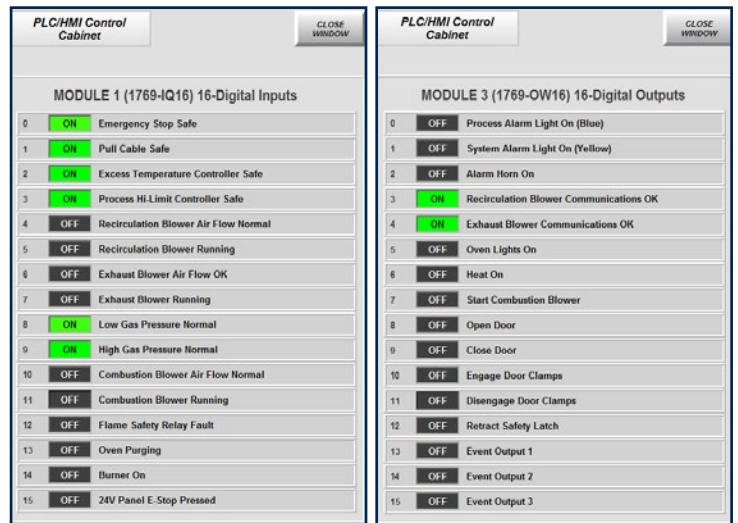
Tuning Heat Cool: Used to adjust the oven tuning parameters.

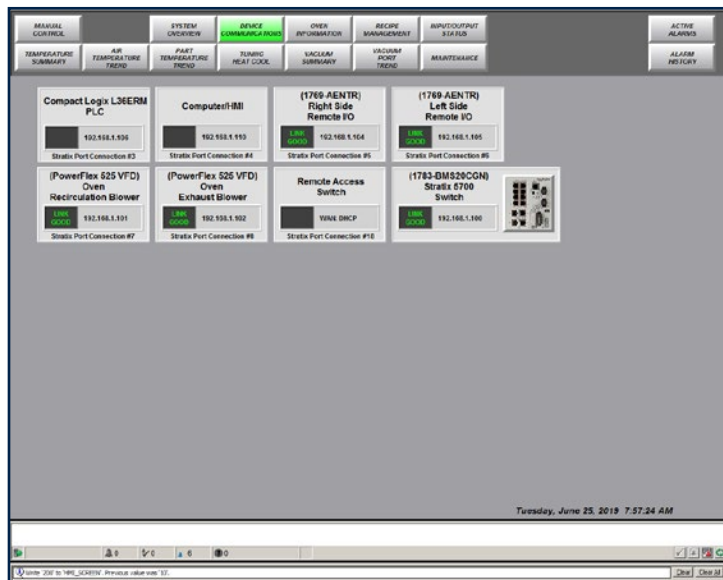


Maintenance: Contains test functions and allows access to configuration values and settings.

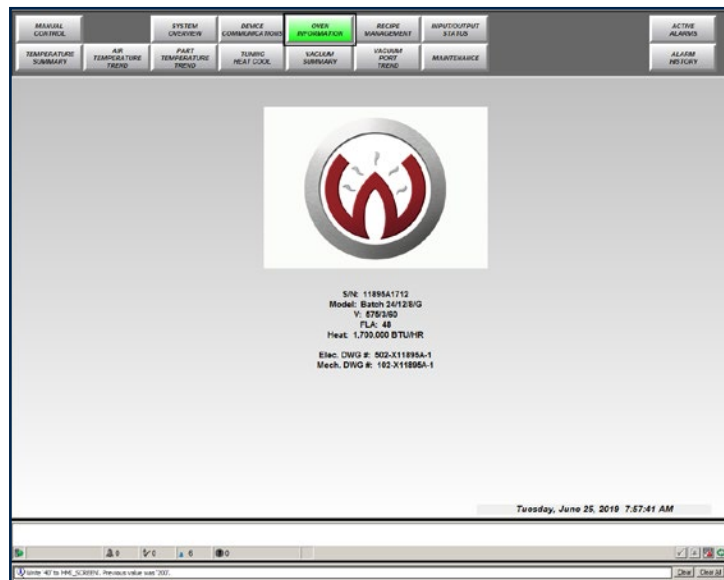


Input/Output Status: Displays the input/output status of all connected PLC inputs and outputs

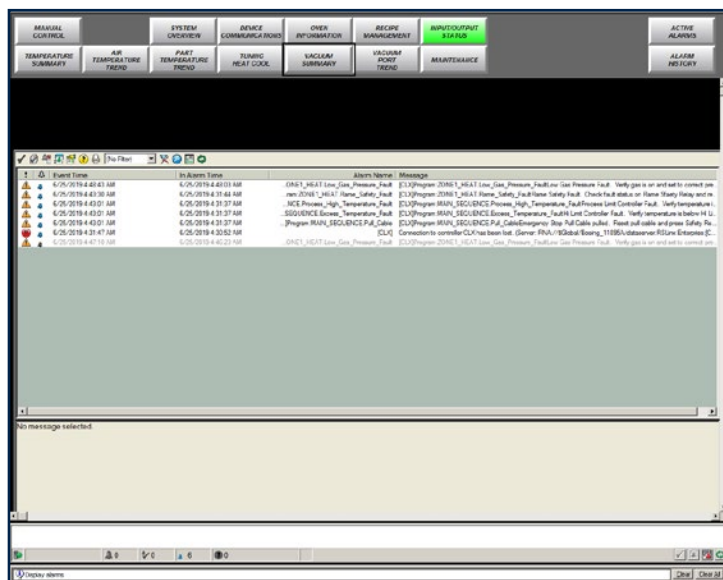




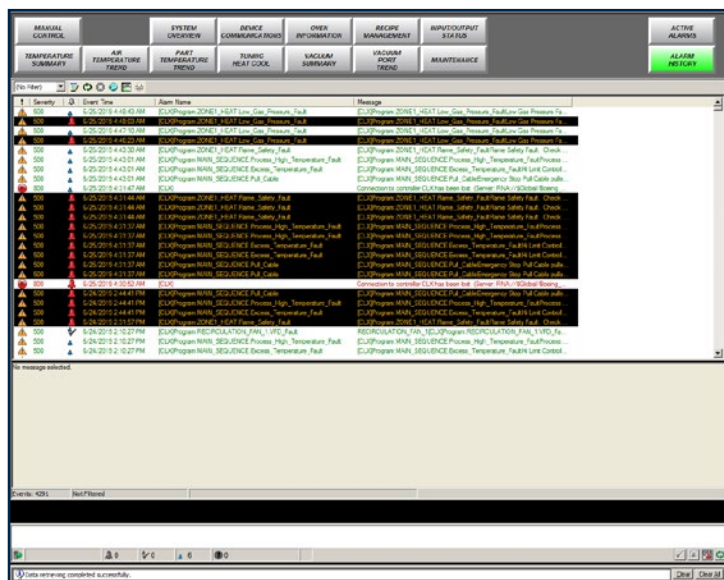
Device Communications: Shows the communication status between the Computer/HMI, PLC, and all other components connected to the network.



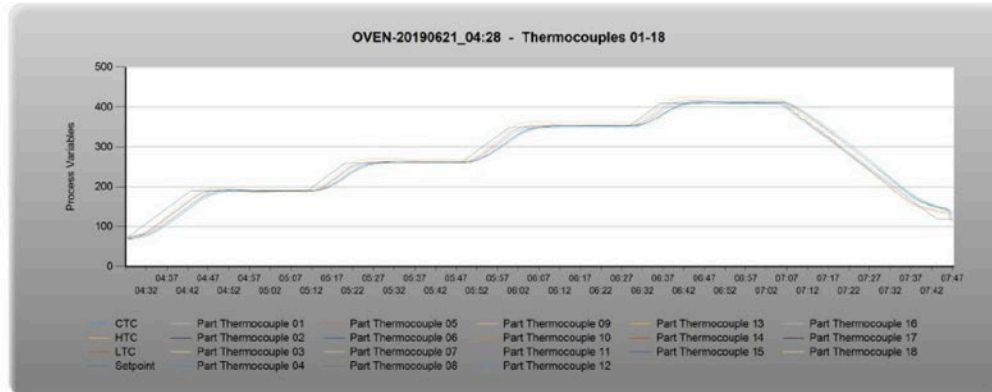
Oven Information: Provides a brief overview of the oven including but not limited to Serial Number, Drawing number, FLA, etc.



Active Alarm: Displays the current active alarms. The user can view/acknowledge/clear alarms from this screen.



Alarm History: Shows historical alarm data. The User can view all alarms from this screen.



Trend

Thermocouple Statistics:

Time Stamp	CTC	HTC	LTC	Oven Ramp Rate	Part Max Ramp Rate	Part Low Ramp Rate	Part Avg Ramp Rate	Setpoint	Segment
4:28:00	72.9	73.6	69.3	3.3	1.8	1.4	1.3	73.3	0
4:28:30	73.5	74.3	70.1	1.2	1.0	1.6	1.1	77.1	1
4:29:00	74.7	75.9	71.7	1.6	1.6	1.0	1.3	80.9	1
4:29:30	76.0	77.3	73.1	2.7	1.4	1.8	1.7	84.8	1
4:30:00	77.2	78.6	74.4	2.4	2.2	1.4	1.8	88.6	1
4:30:30	78.3	79.9	75.7	2.6	2.0	2.2	1.9	92.4	1
4:31:00	79.6	81.3	77.1	2.1	1.8	1.8	1.9	96.2	1
4:31:30	81.3	83.2	79.0	2.8	2.6	2.2	2.3	100.0	1
4:32:00	83.4	85.6	81.3	3.5	2.6	2.4	2.6	103.8	1
4:32:30	86.1	88.3	84.0	4.6	3.2	3.0	3.2	107.6	1
4:33:00	89.0	91.4	87.0	5.7	4.0	3.2	3.6	111.4	1
4:33:30	92.4	94.8	90.4	6.0	4.6	4.4	4.2	115.3	1

Table

Automatic Batch Report Generation

When a program is completed, the batch report is created and saved locally on the PC. The data can also be exported to Excel using the VantagePoint Portal.

AIR THERMOCOUPLE CALIBRATION REPORT

DATE: 2/13/19 11:27 AM

AS FOUND						
	CALIBRATION TEMPERATURE	INSTRUMENT CORRECTION	SENSOR CORRECTION	FIXED BIAS	TOTAL CORRECTION	
CTC	#1	250.0	0.0	-0.9	-2.5	-3.4
	#2	350.0	0.0	-1.4	-2.5	-3.9
	#3	350.0	0.0	-1.4	-2.5	-3.9
	#4	350.0	0.0	-1.4	-2.5	-3.9
	#5	350.0	0.0	-1.4	-2.5	-3.9

AS LEFT					
	CALIBRATION TEMPERATURE	INSTRUMENT CORRECTION	SENSOR CORRECTION	FIXED BIAS	TOTAL CORRECTION
#1	100.0	0.0	0.0	-0.8	-0.8
#2	250.0	0.0	0.0	-0.8	-0.8
#3	350.0	0.0	0.0	-0.8	-0.8
#4	400.0	0.0	0.0	-0.8	-0.8
#5	500.0	0.0	0.0	-0.8	-0.8

Calibration Report Generation

After completing the calibration procedure, the operator can run the calibration report, which is created and stored locally on the PC.

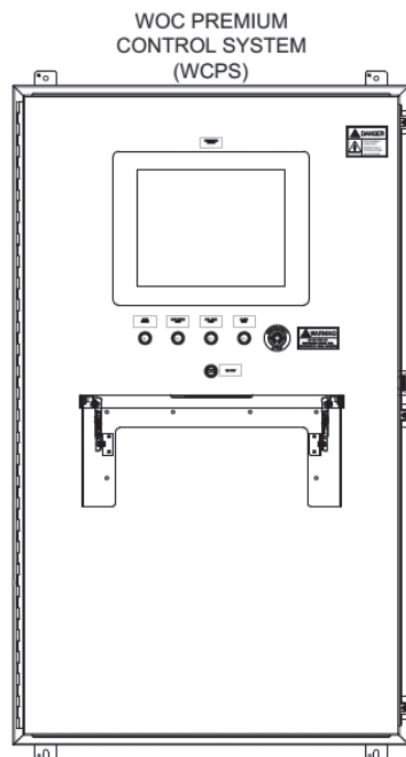


THE BASE WPCS SYSTEM INCLUDES:

- Universal Analog Inputs (T/C, RTD, Voltage, or Current)
- 4-20ma Analog Outputs
- Digital Inputs (24VDC)
- Relay Outputs
- 17" Touchscreen Operator Interface
- Ethernet Switch
- NEMA12 Enclosure
- 24VDC Power (AC Powered systems are also available)
- On board data logging and archiving

AVAILABLE OPTIONS:

- UPS
- Barcode Scanner
- Remote Access Switch (Webport)



The WPCS can be fully configured and ready to run upon delivery. No customer action is required other than mounting the system and landing field wiring.

Systems can be provided with any number of analog inputs/outputs, PID loops, and discrete I/O points.

Wisconsin Oven Representatives can quickly provide system pricing based on the following information:

1. Type of application (single-zone oven, multi-zone oven, etc.)?
2. Number of thermal measurement devices (T/C's or RTD's) required (main, zone, part, etc.)?
3. Number of analog inputs required (vacuum, other)?
4. # of control loops required (temperature, vacuum, pressure, atmosphere, etc.)?
5. # of loops that are Heat/Cool
6. Gas or electric heat system?
7. Discreet Input voltage? (24VDC, 120VAC)
8. # of discreet inputs required with functional description
9. # of discreet outputs required with functional description
10. # of Blowers and Fans to be controlled? Start/Stop only or with analog speed control?
11. Peripheral control needed (i.e. Door, Conveyor, Vacuum pumps, etc.)?
12. Other customer specific requirements...



Wisconsin Oven Corporation

2675 Main Street • PO Box 873
East Troy, WI 53120 USA



Thermal Product Solutions, LLC

Wisconsin Oven is owned by Thermal Product Solutions ("TPS"), a leading American manufacturer of industrial ovens, furnaces, pharmaceutical sterilizers, laboratory ovens, environmental temperature chambers, and stability test chambers. TPS brands include Baker Furnace, Blue M, Gruenberg, Tenney, Lindberg, Lunaire, MPH, and Wisconsin Oven.
www.thermalproductsolutions.com

Phone:
(262) 642-3938

Fax:
(262) 363-4018

Web:
www.wisoven.com

Email:
sales@wisoven.com

Product
Videos:



Social
Media:

