THRIVING ON INNOVATION

Despatch
INDUSTRIES

DES2000 CONTROL
INSTRUCTION MANUAL

MINNEAPOLIS • SHANGHAI • BERLIN • SINGAPORE • TAIPEI

Dear Customer,

Thank you for choosing Despatch Industries. We appreciate the opportunity to work with you and to meet your heat processing needs. We believe that you have selected the finest equipment available in the heat processing industry.

At Despatch, our service does not end after the purchase and delivery of our equipment. For this reason we have created the Service Products Division within Despatch. The Service Products Division features our Response Center for customer service. The Response Center will direct and track your service call to ensure satisfaction.

Whenever you need service or replacement parts, contact the Response Center at 1-800-473-7373: FAX 612-781-5353.

Thank you for choosing Despatch.

Sincerely,

Despatch Industries

Despatch

INDUSTRIES

Despatch — Thermal Processing Systems

RANSCO — Environmental Test and Simulation Equipment

Product Warranty
See separate warranty for Standard Products (Form BB7)

Parts, Materials and Labor

Seller warrants the equipment manufactured by Seller and not by others, to be free from defects in workmanship and material under normal use and service for a period of (1) year from the date of delivery or the period of two thousand (2,000) accumulated hours of use, whichever period is shorter. Use or service with corrosive or abrasive chemicals or materials is not deemed normal. The period of the foregoing warranty, in the case of furnaces, shall be ninety (90) days or five hundred twenty-five (525) accumulated hours of use, whichever period is shorter. Components manufactured by others, including expendable items, are warranted only in accordance with the warranty, if any, issued by such other manufacturer.

Buyer shall give Seller written notice of any defects with 14 days after discovery thereof, specifying each particular defect discovered. If such notice is properly given, Seller will correct without charge any workmanship that is demonstrated to Seller's satisfaction to have been defective at the time of installation, and will repair or replace, at Seller's option, without charge, f.o.b. Seller's factory, parts covered by this warranty that upon inspection are found defective under normal use within the warranty period above stated. All work of removal and reinstallation, whether or not found defective, and shipping charges for defective or replacement parts shall be at the sole expense of Buyer.

The foregoing warranty shall not apply to (i) work done or materials furnished by others in connection with installation work performed without supervision by Seller's installation supervisors, or (ii) equipment repaired or altered by others unless such repairs or alterations were specifically agreed to in writing by an Officer of Seller. Seller shall not be liable for consequential damages of any kind which occur during the course of installation of equipment, or which result from the use or misuse by Buyer, its employees or others of the equipment supplied hereunder, and Buyer's sole and exclusive remedy against Seller for any breach of the foregoing warranty or otherwise shall be for the repair or replacement of the equipment or parts thereof affected by such breach.

The foregoing warranty shall be valid and binding upon Seller if and only if Buyer loads, operates and maintains the equipment supplied hereunder in accordance with the instruction manual to be provided upon delivery of the equipment. Seller does not guarantee the process of manufacture by Buyer or the quality of product to be produced by the equipment supplied hereunder, and Seller shall not be liable for prospective profits.

Despatch will repair or replace, at Despatch's option, FOB Despatch's factory, parts and materials covered by this warranty. Despatch is not responsible for parts or material failures resulting from misuse, abuse, inadequate preventive maintenance, acts of nature, or non-conforming utilities, including electrical, fuel supply, environmental and intake/exhaust provisions. This warranty also does not cover normal wear or routine maintenance parts and materials expressly designed as expendable/consumable and replaceable. (Note: Laboratory oven electric heaters are warranted for a period of five [5] years from date of shipment; three [3] years from date of shipment for Protocol Plus and DES 2000 temperature controllers.)

Labor services for parts and materials replacement and repair to support this warranty are available at Despatch's normal service fees. This service is provided worldwide by a network of factory trained professionals.

Transportation Costs

All transportation costs to transport defective parts or materials to Despatch, and to transport repaired or replacement parts or materials to Customer, shall be the responsibility of the Customer.

Terms and Conditions

This Warranty shall be deemed valid and binding upon Despatch if and only if the Customer:
1. installs, loads, operates, and maintains the covered product supplied hereunder in accordance with the instruction manual provided upon delivery and product labeling affixed to the subject equipment;

2. if applicable, follows the Emergency Procedure set forth in this Warranty; and
3. contacts Despatch's Helpline at 1-800-473-7373 for assistance in diagnosing and troubleshooting the problem immediately upon discovering any damage or malfunction.

Despatch's reasonable determination as to whether a repair, replacement, or service is covered by this Warranty shall be final and binding.

Exclusions

This Warranty DOES NOT cover:
1. damage or malfunctions, or expenses incurred in the process of diagnosing and/or repairing damage or malfunctions, resulting from any of the following: operator error, misuse, abuse, inadequate preventive maintenance, normal wear and tear, service or modifications by other than Despatch authorized technicians, use of the covered product that is inconsistent with the operation manual or labeling, acts of nature (including, without limitation, floods, fire, earthquake, or acts of war or civil emergency), internal or external corrosion, or non-conforming utilities (including, without limitation, electrical, fuel supply, environmental and intake/exhaust installations);
2. repair or replacement of parts or materials designed and intended to be expendable or consumable;
3. routine maintenance; or
4. labor costs incurred for troubleshooting, diagnostics, or testing (except for testing required to verify that a covered defective part or material has been repaired).

Limitations of Liability

Despatch shall not, in any event, be liable for indirect, special, consequential, incidental, or punitive damages or penalties of any kind, including, without limitation loss of revenue, profits or business opportunities resulting from interruption of process or production. In no event shall Despatch be liable for damages in excess of the amounts paid by Customer to Despatch with respect to the applicable product(s). This Warranty does not cover, and Despatch shall not be liable for any losses, costs, damages or expenses resulting from delays in diagnosing or repairing the products, supplying or obtaining replacement parts or materials, strikes, labor stoppages or shortages, fires, accidents, government acts or regulations, or any other causes beyond the control of Despatch.

Non-Compliance By Customer

Despatch reserves the right to suspend and withhold service under this Warranty in the event of non-compliance by the Customer to any terms and conditions of this Warranty or the applicable purchase order or invoice. Further, Despatch shall not be liable for any loss of production, expenses, and inconveniences incurred due to such suspension.

Customer Furnished Equipment Warranty Limitation

This Warranty does not cover diagnosis or repairs of defects in or caused by, lack of performance of, or fitness for purpose of customer-supplied parts or equipment unless specifically noted in the Despatch written order acceptance confirmation.

Performance Commitment

Despatch provides no guarantee of process performance or fitness for purpose, unless specifically noted otherwise in Despatch written order acceptance confirmation. Despatch is providing equipment with design parameters specific only to its equipment.

Procedure Upon Discovery of Defects and Emergencies

In the event Customer becomes aware of any defect in the applicable products, Customer must immediately: (a) shut off fuel or energy supply (gas and electricity), (b) call for emergency assistance, if needed, and (c) notify Despatch Service.

THE REPRESENTATION AND WARRANTIES SET FORTH HEREIN ARE EXCLUSIVE AND IN LIEU OF, AND CUSTOMER HEREBY WAIVES AND DISCLAIMS RELIANCE UPON, ALL OTHER REPRESENTATIONS AND WARRANTIES OF EVERY KIND WHATSOEVER, WHETHER EXPRESS OR IMPLIED, OR ARISING BY OPERATION OF LAW OR IN EQUITY, OR BY COURSE OF PERFORMANCE OR DEALING OR USAGE OF TRADE, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

THIS WARRANTY IS PERSONAL TO THE CUSTOMER AND MAY NOT BE TRANSFERRED OR ASSIGNED. ALL LIMITATIONS HEREUNDER, HOWEVER, SHALL BE BINDING ON ALL SUCCESSORS AND ASSIGNS OF CUSTOMER.

Service
Worldwide Phone 612-781-5356; Worldwide Fax 612-781-5485; North American Phone 800-473-7373
e-mail service@despatch.com; www.despatch.com

Please see reverse side for other service offerings

BB5 (12/5/02)

Despatch Industries
Advantage Service Assurance Program (ASAP)

CONTACT: DESPATCH SERVICE AGREEMENTS SPECIALIST at 800-473-7373 or 612-781-5356
or e-mail: service@despatch.com

Despatch continues to deliver exceptional products backed by a strong sense of responsibility and drive for long term customer satisfaction. Your partnership with Despatch can offer even higher value through your subscription to one of Despatch's Advantage Service Assurance Program (ASAP).

Warranty

Despatch's exclusive, comprehensive service programs start with the 1 year parts only warranty which is described on the other side of this document. This warranty can be expanded immediately to meet your most stringent service needs. Despatch Service Products Group will be able to answer your service questions and provide a quotation for the immediate expansion of your product warranty. Call 800-473-7373 or 612-781-5356; or e-mail service@despatch.com.

Immediate Service Response

The key to an effective service program is response. Wherever your location, Despatch is only a phone call away. Our U.S. and Canadian customers can reach Despatch at 1-800-473-7373. Worldwide customers can call 1-612-781-5356 or FAX 1-612-781-5485. Our Customer Service Technicians have over 150 years combined experience and access to detailed design and manufacturing documentation specific to your Despatch unit(s). This exacting level of service is a benefit only Despatch can provide and means that you can expect speedy, accurate and the most cost effective response.

Field Service Network

A worldwide network of factory trained Service Professionals is available to support your Despatch equipment. From routine repair to certified instrument calibration, the Despatch service network is positioned to respond to your needs. As a manufacturer of custom equipment, our service programs are customized to meet your specific needs regarding:

1. Service scope
2. Response time
3. Preventive maintenance frequency and content
4. Payment method

Sustained Service Support

At Despatch, long term customer satisfaction means more than just responding quickly and effectively to our customers' service needs. It means offering comprehensive customer support well beyond the scope and duration of our initial warranty. Despatch offers two basic service packages which are customized to each individual customer's need. These service packages are titled Full Service and Preventive Maintenance Plus+ service agreement products. Each is unique in the industry and offer the following benefits:

1. Priority response for minimum production interruption
2. Preventive maintenance for longer product life
3. Discounts on parts and services
4. Various payment plans to ease budgeting and recording expenses
5. Reduce purchase ordering costs

TABLE OF CONTENTS

INTRODUCTION

The features of the DES2000 controller include:

- PID Tuning

- Display can show process variable or setpoint during normal operation

- Solid state output to operate a solid state relay

The DES2000 controller is a microprocessor-based digital control instrument. The instrument can be configured as a proportional controller. Initially the CONTROL will allow the heater to operate at full power. However, as the actual oven temperature reaches the setpoint, the Proportional Control will cycle the heater on and off, minimizing process temperature fluctuations.
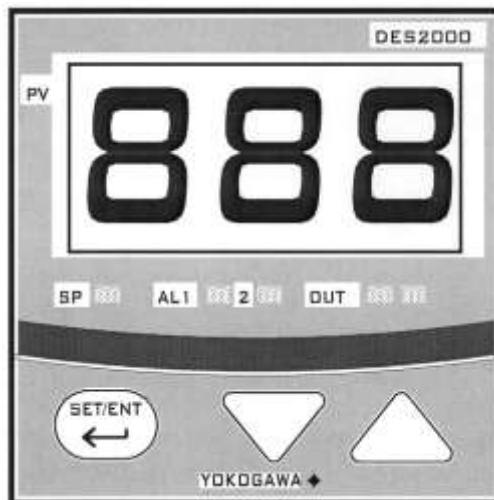
Figure 1. DES2000 CONTROL Instrument

Table 1 CONTROL Instrument Features

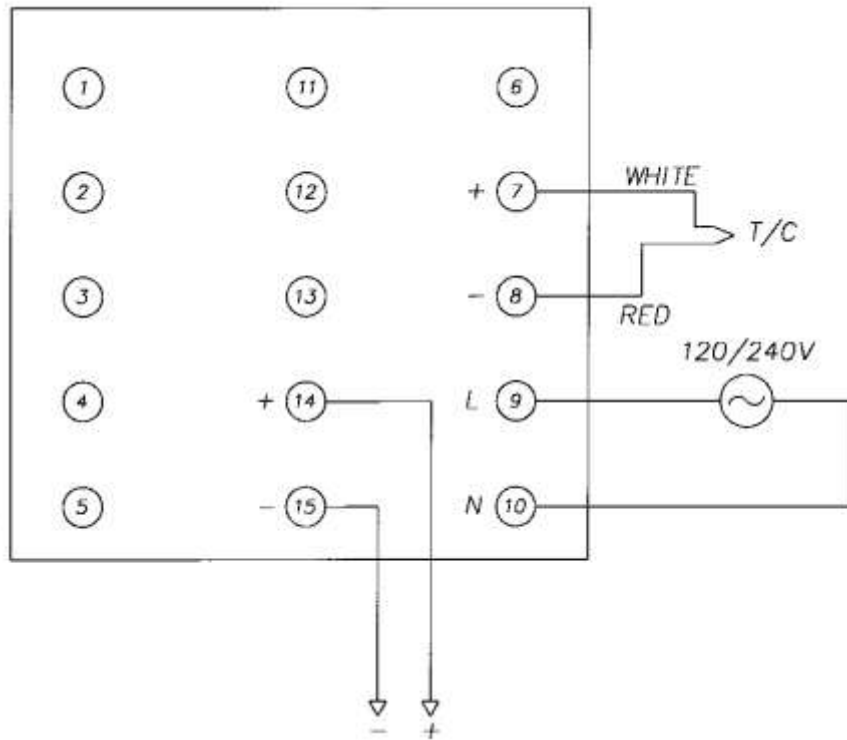| Features	Description
Main Display	Displays the actual oven temperature or displays the setpoint when the set key is pressed. Displays parameter code and value.
SET/ENT Key	Switches between PV and SP displays. Enters the data changed by the □ or □ keys. Switches through parameter displays.
Down Key □	Decreases a setpoint or mode parameter.
Up Key □	Increases a setpoint or mode parameter.
LED SP Indicator	Lights when the setpoint value is displayed.
LED OUT Indicator	Lights when the control is calling for heat.
LED AL1–2 Indicator	N/A
LED PV Indicator	Lights when process variable is displayed.

Figure 2. DES2000 CONTROL Instrument Connections

OPERATION

For fastest oven heat-up time, close the exhaust vent. After the desired temperature is reached, the vent may be adjusted as needed.
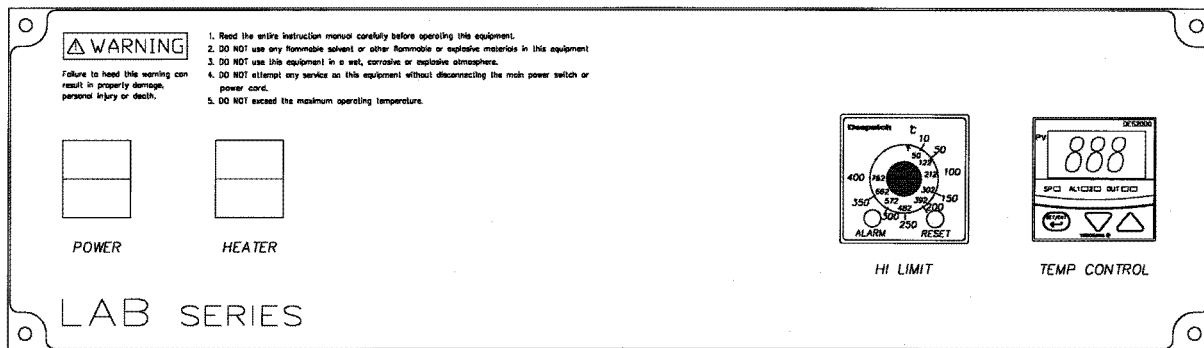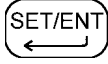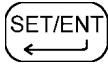
1. Start oven.

   a. Turn **POWER** switch to on.
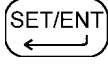
Figure 3. Typical Control Panel

2. Enter setpoint on the CONTROL instrument.

   a. Press [SET/ENT] key until the SP LED is lit.

   b. Use ▲ key and ▼ key to set operating temperature.

   c. Press [SET/ENT] key to enter setpoint.

   d. Press [SET/ENT] key again to display process temperature.

Set HI-LIMIT instrument to a temperature 10°C to 14°C higher than the setpoint or to a temperature that should not be exceeded in the process.

NOTE:
If the HI-LIMIT instrument is exceeded the heater will shut down. Reset the HI-LIMIT by pushing the reset button on the HI-LIMIT instrument.

Parameter Programming Mode

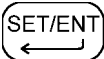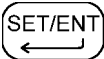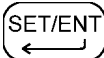The control parameters are set through the Operating and Set-up modes. In most applications, it is not necessary to alter the oven settings. The following instructions describe how to access, view and, if desired, change the parameters.

Once the Operating and Set-up modes are accessed, the SP LED will start blinking on and off.
The CONTROL will not allow the display to be altered improperly.

> WARNING: Make sure you understand what you are changing before doing so. Changing the program parameters will alter the functions of the CONTROL.

The CONTROL will automatically exit the Parameter Programming mode if no keys are pressed for about two minutes.

Operating Parameters

1. Press $\boxed{\text{SET/ENT} \leftarrow}$ key for three (3) seconds.

2. Press the $\boxed{\text{SET/ENT} \leftarrow}$ key until the desired parameter is displayed. See Operating and Setup Parameter Tables on the following pages.

3. Press the ▲ or ▼ once to display value.

4. Use the ▲ or ▼ to the desired setting.

5. Press the $\boxed{\text{SET/ENT} \leftarrow}$ key to enter the value.

6. Press and hold the $\boxed{\text{SET/ENT} \leftarrow}$ key for three (3) seconds to return to the display mode.
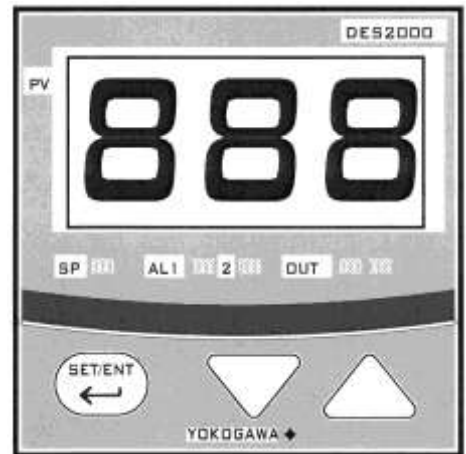
Figure 4. DES2000

On the next page are the parameter codes, listed in order as they appear.

Table 2 Operating Parameter Outline

Code	Name	Settings
CtL	Control Mode	PID
At	Auto-tuning	OFF
P *	Proportional Band	5 **
I	Integral Time	120
d	Derivative Time	0
Ct	Cycle Time	1
FL	Input Filter	2
bS	PV Bias (Offset)	0
LoC	Key Lock	0

  * If P is not displayed the Control Mode (CtL)
   must be first set to Pid.
  **For F change to value 13.

Definitions for Table 2:

CtL Control Mode - This parameter determines whether controller functions as a time proportional or an on/off control.

At Auto-tuning – Off for PID tuning, ON for controller to tune process.

P Proportional Band - Expressed in degrees. This value determines the band width on both sides of the setpoint within which the control provides proportional control.

I Integral Time - Expressed in seconds. This parameter corrects for errors in actual temperature versus the setpoint.

D Derivative Time - Expressed in seconds. This effect of the derivative time is in direct proportion to the time setting.

Ct Cycle Time - Expressed in seconds. This is the total time for one ON/OFF cycle of the controller output during the proportional action.

FL Input Filter – Expressed in seconds. This function should be used when the PV may fluctuate greatly (i.e. input signal contains noise).

bS PV Bias - Expressed in percent of span. From –100 to 100% of span, this parameter used to set the actual oven temperature to the controller display.

LoC Key Lock - This provides levels of access to the controller.
   0 = No key lock, full access to controller.
   1 = Prevents changing of all parameters except setpoint.
   2 = Prevents all parameters from being changed including the setpoint.
   –1 = Set to enter the Setup parameter setting display.

When LoC = -1, the parameters are displayed in the order shown in the Set-Up Parameters section, below.

Set-Up Parameters

1. Go into the operating parameters and change the LOC parameter to –1 and press the SET/ENT key to access the Setup Parameters.

Table 3 Set-Up Parameters for Degrees Centigrade

Code	Parameter Name	Setting
In	Input Type	5
SPH	Maximum Setpoint Limit	Use value from Table 5 (below)
SPL	Minimum Setpoint Limit	Use value from Table 5 (below)
SC	Super Function	OFF
dr	Direct/Reverse Action	0
DSP	Display Priority	0

Table 4 Set-Up Parameters for Degrees Fahrenheit

Code	Parameter Name	Setting
In	Input Type	35
SPH	Maximum Setpoint Limit	Use value from Table 5 (below)
SPL	Minimum Setpoint Limit	Use value from Table 5 (below)
SC	Super Function	OFF
dr	Direct/Reverse Action	0
DSP	Display Priority	0

Table 5 Oven Models and Temperatures
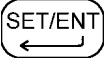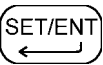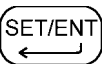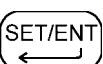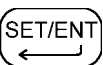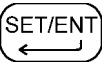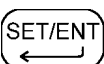
Oven Model	Degrees F		Degrees C	
	Maximum	Minimum	Maximum	Minimum
LAC	500	95	260	35
LAD/LFD/LND/LXD	650	95	343	35
LBB	400	86	204	30

NOTE: If the "In" code is changed, the "P" code in the operating parameters may have to be reset.

2. Press and hold the SET/ENT key for three seconds to return to normal operation.

Definitions for Tables 3 and 4:

In   Input Type - See Input Range Codes (Table 6)

SPH   Setpoint High - This should be set to the maximum operating temperature of the equipment.

SPL   Setpoint Low - This is the minimum operating temperature of the equipment.

dr   Direct/Reverse Action - For heating this should be reverse acting
            0 = reverse   1 = direct

DSP   Priority of the display - This is the value to be displayed in normal operation
            0 = process variable   1 = setpoint

Table 6 Input Range Codes

Input type		Range ºC	Range code ºC	Range ºF	Range code ºF
Thermocouple	K	-199 to 999ºC	1	-199 to 999ºF	31
		0 to 600ºC	2	32 to 999ºF	32
		0 to 400ºC	3	32 to 750ºF	33
		-199 to 200ºC	4	-199 to 400ºF	34
	J	-199 to 999ºC	5	-199 to 999ºF	35
	T	-199 to 400ºC	6	-199 to 750ºF	36
	E	-199 to 999ºC	7	-199 to 999ºF	37
	L	-199 to 900ºC	12	-199 to 999ºF	42
	U	-199 to 400ºC	13	-199 to 750ºF	43
RTD	Pt100	-199 to 850ºC	15	-199 to 999ºF	45
		0 to 400ºC	16	32 to 750ºF	46
		-199 to 200ºC	17	-199 to 400ºF	47
		-19.9 to 99.9ºC	18		
	JPt100	-199 to 500ºC	19	-199 to 999ºF	48

Changing Display From °C To °F
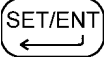
The control can be configured for either °C or °F. Use the following steps to change control from displaying °C to °F.

> **WARNING:** Make sure you understand what you are changing before doing so. Changing the program parameters will alter the functions of the CONTROL.

1. Press and hold the ⌊SET/ENT⌋ for three (3) seconds.

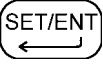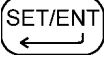2. The display will read **CtL**. The SP LED will flash indicating that Operating Parameter mode has been entered.

3. Press the ⌊SET/ENT⌋ until **LoC** appears on the display.

4. Press the ▲ or ▼ once to enter the parameter.

5. Press the ▼ to set the value to **–1**. The SP LED will flash rapidly, indicating that the Set-Up Parameter mode has been entered.

6. Press the ⌊SET/ENT⌋ to enter the value. The display will read **In**.

7. Press the ▲ or ▼ once to enter the parameter.

8. Press the ▲ to set the value to **35**. The right decimal point LED will flash indicating that the setting is being changed. This will stop flashing when the new value has been entered.

9. Press the ⌊SET/ENT⌋ to enter the value.

> **NOTE:** To change from °F to °C repeat the above steps. The following are the values to be entered:
>
> **In = 5**
> **SPH = 204**
> **SPL = 0**
> **P = 5**

10. Press the ⌊SET/ENT⌋ until **SPH** is displayed.

11. Press the ▲ to set the value to **400**.

12. Enter a value of **400**.

13. Press the ⌊SET/ENT⌋ to enter the value.

14. Repeat steps 12 –14 for **SPL**; the value is **32**.

15. Press and hold the ⌊SET/ENT⌋ for three (3) seconds to return to the operation mode.

16. Press and hold the [SET/ENT] for three (3) seconds.

17. The display will read **CtL**. The SP LED will flash indicating that Operating Parameter mode has been entered.

18. Press the [SET/ENT] until P appears on the display.

19. Press the □ or □ once to enter the parameter.

20. Press the □ to set the value to 5. The SP LED will flash indicating that the setting is being changed.

21. Press the [SET/ENT] to enter the value.

22. Press and hold the [SET/ENT] for three (3) seconds to return to the operation mode.

23. The control now reads °F. Enter the desired setpoint.

Oven Zone Calibration

The CONTROL instrument has been tested and calibrated at the factory. Under normal operating conditions, recalibration should not be necessary. However, if the instrument does not comply with known standards, OR if the user would like to recalibrate the CONTROL for a specific operating condition, then recalibration is easily accomplished.

Calibration Instructions

(Equipment needed: Temperature Measuring Device with a Compatible Temperature Sensor)

1. Verify that the bS (PV Bias) operating parameter in the control is programmed to 0. Refer to Instructions on viewing the parameter in the OPERATING mode in the Appendix of this manual.

2. Locate the temperature sensor of the temperature measuring device at the center of the chamber.

3. Operate the oven until it reaches the desired operating temperature and the CONTROL is cycling the heater on and off. The user may wish to have a loaded chamber with a standard amount of product to simulate a specific operating condition. It will take several minutes for the unit to stabilize at the controlled temperature. Allow at least 30 minutes of operation at the stabilized temperature before proceeding.

4. Subtract the average controlled temperature (number appearing on the CONTROL display) from the actual oven temperature (number appearing on the temperature measuring device display). The CONTROL and the device must be in the same scale (°C or °F).

    Actual Oven Temperature - Controlled Temperature = calculated value

5. Enter the calculated value from Step 4 as the new bS (PV Bias) value in the instrument.

APPENDIX

Troubleshooting

Equipment that operates for long periods may develop problems. The DES2000 was designed to have minimal problems; however, if there are problems please do the following:

1. Have a qualified maintenance person verify wiring is correct.

2. Check the tuning and configuration parameters.

3. Verify that the thermocouple is working properly.

4. If everything is set up correctly, contact the Despatch Help Line at 800-473-7373 for assistance.

Table 7 Error Displays and Content

Display	Error Content
Unknown (at power-on)	CPU failure
"Err" (at power-on)	Calibration abnormal
Flashing "Err" (at power-on)	RAM or ROM failure
Flashing "Err" (during operation)	A/D converter failure, RJC failure, or EEPROM failure
000 or b.o	Open thermocouple

Table 8 Difficulties, Probable Causes, and Remedies

Difficulty	Probable cause	Suggested Remedy
Failure to heat	CONTROL instrument malfunction	Check parameter in controller or replace controller if OUT LED on controller does not turn on.
Erratic temperature	CONTROL instrument malfunction	Check control parameters before replacing the CONTROL instrument.
Inaccurate temperature	CONTROL instrument miscalibration	Recalibrate CONTROL instrument.
Oven will not control at setpoint	HI-LIMIT instrument set too low	Set the HI-LIMIT higher.
	CONTROL instrument malfunction	Check control parameters before replacing CONTROL instrument.
	Air friction of recirculation fan	Open exhaust air vent. Unit will not control at minimum operating temperature with vent(s) closed.
Heater does not shutdown until temp. reaches the HI-LIMIT setting	CONTROL instrument malfunction	Verify control parameters. Replace relay if no output exists. Replace CONTROL instrument if 5VDC output exists.
	SSR Relay malfunction	Replace relay if no CONTROL output exists.

Technical Specifications

UL, cUL listed: UL file E136675

CE compliance to:
- EN55011: Class A, Group 1 for EMI (emission)
- EN55082-2: 1995 for EMS (immunity)

Power supply: 100 to 240 VAC + 10% -15%, 50-60 Hz 8VA Maximum
Temperature:
- Storage -25º to 60º C
- Operating 0º to 50º C

Humidity: 5% to 90% RH (no condensation allowed)

Sensor inputs:
- Universal
- Input: 1 point
- Sampling period 500 ms
- Applicable standards
  Thermocouple and resistance temperature detector
  JIS/IEC/DIN ITS90

Temperature display:
- 1º resolution (C or F)
- Accuracy after calibration of +/- 1º C, or +/- 0.2º of sensed temperature (whichever is greater) @25º C
- Three digit seven segment LED, 0.75 inches high

Heat control output: SSR Drive 24VDC nominal @ 40 ma

Front panel: NEMA 4X (with gasket)

Dimensions: 1.87H x 1.87W x 3.25D inches

Panel opening: 1.77H x 1.77W inches