

INSPIRED INNOVATION

Despatch
INDUSTRIES

RAD1-42-2E WITH PROTOCOL 3™ CONTROLLER OWNER'S MANUAL

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VERSION 1
5/2012

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Revision History

Revision	Date	Author	Description
1	5/2012	Livingston	Revised for Protocol 3 and revised format.

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1. About This Manual

1.1. Important User Information


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
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In no event will Despatch Industries be liable for technical or editorial omissions made herein, nor for direct, indirect, special, incidental, or consequential damages resulting from the use or defect of this manual.

	<p><i>Values displayed on screens are examples only. Though those values may be typical, contact Despatch Industries for the final value.</i></p>
---	--

	<p><i>Users of this equipment must comply with operating procedures and training of operation personnel as required by the Occupational Safety and Health Act (OSHA) of 1970, Section 5 and relevant safety standards, as well as other safety rules and regulations of state and local governments. Refer to the relevant safety standards in OSHA and National Fire Protection Association (NFPA), section 86 of 1990.</i></p>
---	---

	<p><i>Danger!</i></p> <p><i>Only fully-trained and qualified personnel should setup and maintain this equipment. Improper setup and operation of this equipment could cause an explosion that may result in equipment damage, personal injury or possible death.</i></p>
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The information in this document is not intended to cover all possible conditions and situations that might occur. The end user must exercise caution and common sense when installing or maintaining Despatch Industries products. If any questions or problems arise, call Despatch Industries at **1-888-DESPATCH** or **1-952-469-5424**.

1.2. **Manufacturer & Service**


The RAD1-42-2E oven is manufactured by Despatch Industries.

Despatch has specialized in thermal processing for over 100 years. Technical expertise gained over those years helps provide innovative solutions to critical applications in vertical markets and cutting edge technology worldwide. Despatch products are backed by a drive for long-term customer satisfaction and a strong sense of responsibility. The worldwide network of factory-trained Service Professionals is available to support your Despatch equipment. From full service preventive maintenance to routine repair and certified calibration and uniformity, the Despatch service network is positioned to respond to your business needs. Our service programs are customized to meet your specific needs using our Advantage Service Assurance Program (ASAP). For more information on ASAP, visit www.despatch.com.



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1.3. **Organization of this Manual**

This owner's manual contains the most comprehensive set of information for the Despatch RAD1-42-2E oven, including installation instructions, theory of operation, and operating instructions, among other things.

	<i>Danger!</i> <i>Failure to heed warnings in this instruction manual and on the oven could result in personal injury, property damage or death.</i>
---	---

1.4. Conventions

	<i>This icon signifies information that describes an unsafe condition that may result in death, serious injury, or damage to the equipment.</i>
Danger!	<i>Danger is the signal word used to indicate a hazardous situation that, if not avoided, will result in death or severe injury.</i>
Warning!	<i>Warning is the signal word used to indicate a hazardous situation that, if not avoided, could result in death or severe injury.</i>
Caution!	<i>Caution is the signal word used to indicate a hazardous situation that, if not avoided, could result in moderate or minor injury.</i>
Notice	<i>Notice is the signal word used to indicate a hazardous situation that, if not avoided, could result in property damage.</i>
	<i>This icon signifies supplemental important information.</i>
LOG OUT	<i>Bold, 10 point sans-serif typeface indicates a specific key or button on screen to click.</i>

1.5. Specifications

1.5.1. Dimensions

Models	Chamber Size inches (cm)			Capacity ft ³ (liters)	Overall Size inches (cm)			Maximum number of Shelves	Exhaust Outlet Diameter in (cm)
	W	D	H		W	D	H		
RAD 1-42-2E	20 (50.8)	18 (45.7)	20 (50.8)	4.2 (119)	46 (116.8)	31.5 (80)	37.5 (95.3)	8	2.5 (6.4)

1.5.2. Capacities

Capacity	Model RAD1-42-2E
Maximum load (Lbs) (KG)	200 91
Maximum shelf capacity (Lbs)	30

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Capacity	Model RAD1-42-2E
(KG)	13.6
Exhaust Capacity	Adjustable to 12 CFM (5.6 lps)
Recirculating fan (CFM) (H.P.)	425 (200 lps) 1/2
Net weight (Approximate) (Lbs) (KG)	350 159
Shipping weight (Approximate) (Lbs) (KG)	480 218

1.5.3. Temperatures

Feature	Range	Model RAD1-42-2E
Time to Temperature Minutes (No Load)	40°C to 177°C	10
	40°C to 260°C	20
	40°C to 343°C	38
Recovery Time Door Open 1 Min	100°C	<1
	200°C	3
	343°C	10
Cooling Time to Temperature Minutes (No Load)	343 - 50°C (damper open)	180
	343 - 75°C (damper closed)	130
Temperature Uniformity at*	177°C	+/- 2.3° C
	260°C	+/- 3.4° C
	343°C	+/- 4.2° C
Minimum Operating Temperature above ambient (Approximate w/20°C ambient)	20°C	
Control Stability (Δ represents the change in ambient temperature)	+/- 0.5°C/5°C Δ	
Repeatability	+/- 0.5°C	

* Uniformity figures are based on a nine-point test conducted in an empty oven after stabilization period. Uniformity can vary slightly depending on unit and operating conditions. Minimum operating temperature and cooling times are based on 20°C ambient temperature measured at the fresh air inlet with the fresh air and exhaust dampers fully open. Specifications are subject to change without notice.

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1.5.4. Power

Line voltages may vary in some geographies. If the line voltage for your RAD1-42-2E oven varies more than 10% from the oven voltage rating, electrical components such as relays and temperature controls may operate erratically.

- If the line voltage is lower than the oven voltage rating, heat-up time may be significantly longer and motors may overload or run hot.
- If the line voltage is higher than the nameplate rating, motors may run hot and draw excessive amperage.

Model	Volts †	Amps	Hertz	Phase	KW
RAD1-42-2E	240	30	50/60	1	6-
RAD1-42-2E	208	33.7	50/60	1	6-

	<p>Warning!</p> <p><i>This oven is not designed for use with flammable material. If your process involves flammable material, see the RFD Class A series.</i></p>
---	--

† An oven designed for 240 volts (see oven nameplate) will operate satisfactorily on a minimum of 208 Volts, but will result in 25% reduced heater output. If your power characteristic is lower, contact Despatch Industries.


2. Safety

2.1. Safety Information

Do not work on the RAD1-42-2E oven without reading and understanding this section which contains important information and warnings. Ignoring these warnings can result in death, serious injury or damage to the machine and product.

2.1.1. Lockout

Machine lockout places the RAD1-42-2E oven into a zero energy state and prevents accidental machine start up. Always follow the Lockout Procedure described in this section before cleaning, maintaining or repairing the RAD1-42-2E oven.

	<p>Danger!</p> <p><i>An accidental start-up, while working on the RAD1-42-2E oven, can result in serious injury or death.</i></p>
---	--

2.1.1.1. Lockout Requirements

1. Every power source that can energize any element of the RAD1-42-2E oven must be shut off at the closest possible power source. This includes air, water, electricity, and the Disconnect Switch (if applicable).
2. After energy sources are locked out, test to ensure circuits are de-energized.

2.1.1.2. Lockout Procedure

Personnel authorized to lockout equipment must have the necessary locks to perform the lockout.

	<p>Danger!</p> <p><i>Electrical panels contain high voltage. Disconnect and lock out the power supply before working inside any electrical panels. Failure to lock out the power supply can result in death or injury.</i></p>
---	---

1. Physically disconnect all electrical power to the machine or lockout the appropriate breaker or disconnects.
2. Close all valves and bleed off any pressure.
3. Test for power by attempting a start with the machine controls.
4. Identify the Lockout Condition with a tag on the electrical disconnect and pneumatic shut off valve.
5. When work is complete, remove all tags and restore the machine to its working state.

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2.2. Maintenance

Only qualified and trained personnel should perform maintenance or repair.

2.3. Electrical Power

Only qualified and trained personnel should perform electrical maintenance or electrical repair.


	<p>Danger!</p> <p><i>Contact with energized electrical sources may result in serious injury or death.</i></p>
---	--

- Before performing maintenance, disconnect all electrical power from the machine. Use a padlock and lockout all disconnects feeding power to the machine.
- Never clean or repair the oven when in operation.
- Unauthorized alterations or modifications to RAD1-42-2E oven are strictly forbidden. Never modify any electrical circuits. Unauthorized modifications can impair the function and safety of the RAD1-42-2E oven.

2.4. Fire

Keep the RAD1-42-2E oven clean and free of scrap materials, oil or solvents to prevent the possibility of fire.

1. Leave the door as it is.
2. De-energize the machine immediately by turning OFF the **DISCONNECT SWITCH** (if applicable).
3. Turn off the remote main disconnect (customer supplied disconnect).
4. Shut off fuel.
5. Call the fire department.
6. Stay away.

	<p>Danger!</p> <p><i>Always disconnect all power before extinguishing a fire. Attempting to extinguish a fire in a machine connected to electrical power can result in serious injury or death.</i></p>
---	--

2.5. Equipment Lockout Requirements

To prevent injury or equipment damage during inspection or repair, the RAD1-42-2E oven must be locked out.

2.5.1. *Optional Disconnect Switch*

The RAD1-42-2E oven has an optional Disconnect Switch (Figure 1). This Disconnect Switch is located on the front of the oven and connected to the load break switch behind the panel that disconnects or connects power from the main line. When a risk of personal injury or damage to the RAD1-42-2E oven exists, turn off the Disconnect Switch. This shuts off all electrical power to the oven.



Figure 1. Disconnect Switch.

3. Theory of Operation

3.1. The RAD1-42-2E Oven

Despatch RAD1-42-2E ovens (Figure 2) effectively distribute heat and have very fast processing times compared to other lab ovens their size. Because of effective heat distribution and fast processing times, the RAD1-42-2E ovens are especially useful for testing, preheating, sterilizing, drying, aging and curing, along with other production applications. Horizontal airflow with precision digital control delivers uniform, fast processing. The overall result is efficient productivity under strenuous conditions.

The unique Despatch computerized design moves forced convected heat through perforated stainless steel walls. The air is recirculated with a high volume fan. The Despatch RAD1-42-2E oven employs a higher volume fan than competitive ovens, allowing dense loading of the chamber without interfering with the process. RAD1-42-2E oven air delivery temperature is within $1/2^{\circ}\text{C}$ of the number appearing on the digital display. Also, fresh air intake is regulated by a damper slide located on the left side of the oven (Figure 3). The exhaust opening is fixed on the RAD1-42-2E oven. The exhaust port, located on the back of the oven, is covered by a hat bracket. For safety reasons, do not remove the hat bracket.

The oven operator interface is located on the control panel to the right of the oven door (Figure 2). The RAD1-42-2E oven has a type 304 stainless steel interior and a scratch-resistant baked enamel exterior. The interior cleans easily, and its construction reduces heat loss and aids in maintaining temperature uniformity. The RAD1-42-2E oven comes with two shelves.

3.2. Damper Control

The RAD1-42-2E oven comes with a manually-adjustable damper mechanism which controls the flow of fresh air into the chamber. The damper control is located on the left side of the oven (Figure 3). The maximum amount of fresh air is distributed into the chamber when the damper is in full open position.

3.2.1. Determining Damper Settings

The optimum setting for the amount of fresh air that should be distributed into the chamber depends on several factors. These factors include ambient environment temperature, load



Figure 2. RAD1-42-2E Oven.

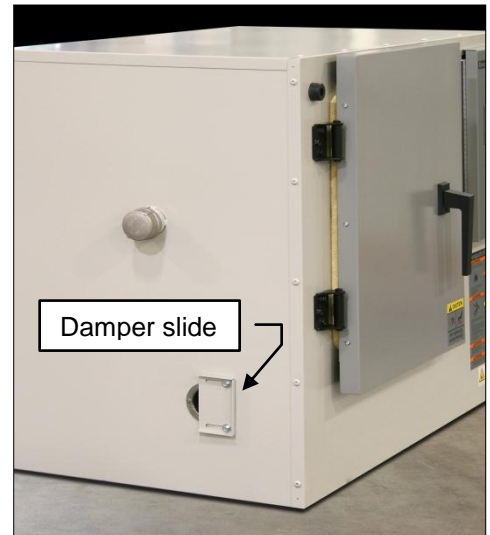


Figure 3. RAD1-42-2E Oven Damper Control.

conditions, load distribution, heat-up rates, cool-down rates, desired temperature uniformity and, most importantly, the desired operating temperature. Carefully consider existing engineering tradeoffs while using guidelines to determine the fresh air damper setting.

In general, the damper should be set so that the amount of fresh air flowing into the chamber agrees with the desired operating temperature conditions. The following paragraphs show the considerations involved with various damper position settings.

3.2.1.1. Damper Full Closed Position

The chamber achieves maximum attainable heat-up rates when the fresh air damper lies in the full closed position. With the damper in the full closed position, the chamber will operate at the desired temperature using the minimum amount of power. In most cases, the oven also efficiently operates at the chamber's maximum operating temperature when in the full closed position.


	<p>Warning!</p> <p><i>This oven is not designed for use with flammable material. If your process involves flammable material, see the RFD series.</i></p>
---	--

3.2.1.2. Damper in Full Open Position

The chamber operates at its minimum operating temperature with the fresh air damper in full open position.

Friction heat from the air recirculation system builds up in the chamber. This causes chamber temperature to rise slightly even without the heating system on. The chamber reaches thermal equilibrium temperature after the recirculation motor runs for an extended period of time.

The chamber cannot readily dissipate heat generated by friction without a fully open fresh air damper. With the fresh air damper fully open, the thermal equilibrium temperature is the minimum operating temperature of the chamber.

	<p><i>When the damper is in full open position, the oven may not be able to heat to the maximum oven operating temperature.</i></p>
---	---

3.2.1.3. Other Damper Settings

Damper settings can take distinct operating positions other than full closed or full open. In most cases, uniformity and cool-down rates influence damper settings.

Chamber Uniformity

The system's inside chamber pressure influences chamber uniformity. Pressure inside the chamber depends on the amount of fresh air flowing into the chamber. When a large volume of fresh air flows into the chamber, the chamber pressurizes slightly and overall temperature

uniformity improves. The slightly pressurized chamber produces the effect of "pushing" air to the corners of the chamber. Typically the corners of the chamber improve with respect to temperature distribution while the core of the chamber maintains excellent uniformity characteristics regardless of damper position.

Pressurization of the chamber typically is a factor when the chamber is loaded heavily. The best uniformity results, with respect to the product, are achieved when no more than two-thirds of any inside chamber dimension are used. The best overall results are achieved when the product(s) are located in the center of the chamber.

Cool-Down Rates

The more open the damper, the faster the cool-down.

Notice	<p><i>Overpressurizing the chamber can cause hot air to blow out around the door seal and cause the area around the door to be hot to the touch. Stop this hot air from entering the room by closing the damper slightly until the air stops blowing.</i></p>
---------------	--

3.3. The Protocol 3 Controller

The Protocol 3™ controller is a microprocessor based digital temperature controller designed for simple and flexible oven operation (Figure 4). The Protocol 3 controller operates as a dual-functioning controller/High Limit instrument. The control portion utilizes a time-proportioning voltage signal to control heating devices with minimal temperature fluctuations.

The High Limit portion protects the product and/or the oven from overheating. If the product being processed has a critical high temperature limit, the High Limit setpoint should be set to a temperature somewhat below the temperature at which the product could be damaged. If the product does not have a critical high temperature limit, the High Limit setpoint should be set 5 to 15 degrees higher than the maximum programmed setpoint at which the oven will operate.

The Protocol 3 controller provides three primary operating modes:

- **Manual:** Oven operates continuously at a fixed temperature until turned off.
- **Timer:** Oven operates at a fixed temperature for a user-selected time period and then automatically turns off.
- **Profile:** Temperatures increase or decrease as defined by 255 segments that can be allocated to 64 ramp and soak profiles. The profiles can be linked to provide additional temperature combinations.

Review the Protocol 3 Controller Owner's Manual for more information.

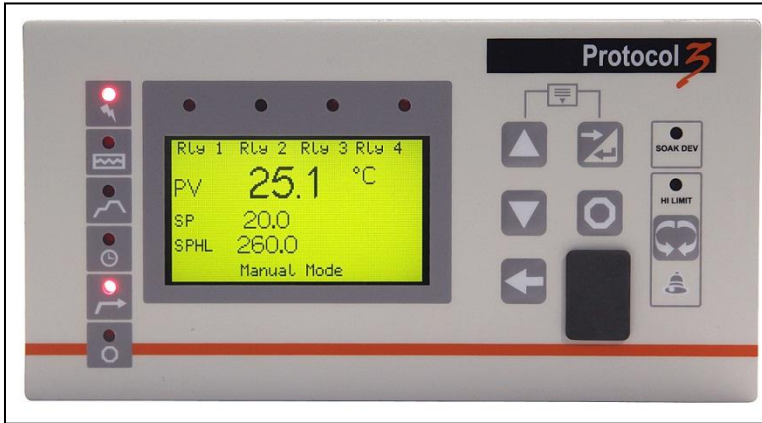


Figure 4. Protocol 3 Operator Interface.

3.3.1. *Optional High Limit Audible Alarm*

High Limit audible and visual alarm is a red light and small alarm horn located on the front of the control panel. The alarm is sounded if a High Limit condition occurs. A switch is provided to silence the alarm. This alarm has a range of 80dB at 2 ft (0.6 m).

3.3.2. *Optional Modbus Communications Hardware*

RS485 Modbus communications are wired from the Protocol 3 controller to the DB9 connector on the side of the oven. A programming manual is included which lists all the messages recognized by the Protocol 3 controller. This manual is intended for those who will write their own software. An RS232 to RS485 converter is required between the PC and a single oven. The manual can also be used with Despatch Protocol Manager software.

4. Assembly & Setup

Assembly and Setup provides directions for unpacking and installing your RAD1-42-2E oven.

4.1. Unpack & Inspect The RAD1-42-2E Oven

Remove all packing materials and thoroughly inspect the oven for any damage that might have occurred during shipment.

- Note the condition of the carton and plastic cover sheet inside the carton.
- Observe all outside surfaces and corners of the oven for scratches and dents.
- Check oven controls and indicators for normal movement, bent shafts, cracks, chips or missing parts such as knobs and lenses.
- Check the door and latch for smooth operation.

4.1.1. If Damaged During Shipping


If damage occurred during shipping:

1. Contact the shipper immediately and file a written damage claim.
2. Contact Despatch Industries (**1-800-473-7373** or **1-952-469-8230** or **service@despatch.com**) to report your findings and to order replacement parts for those damaged or missing. Send a copy of your filed damage claims to Despatch Industries (**Despatch Industries, 8860 207th Street, Lakeville, MN 55044, USA**).
3. Check the packing list to ensure you received all the specified components of the oven system. Contact Despatch Industries to have any missing products forwarded to you.
4. Complete the warranty card and mail it to Despatch within 15 days after receipt of the equipment.

4.2. Setup The RAD1-42-2E Oven

4.2.1. Select Oven Location

The Despatch RAD1-42-2E oven is designed to operate in an industrial setting.

	<p>Warning!</p> <p><i>Do not use the oven in wet, corrosive or explosive atmospheres unless this oven is specifically designed for a special atmosphere.</i></p>
---	---

<p>Notice</p>	<p><i>Review oven weight to ensure the foundation is adequate to hold the weight.</i></p>
----------------------	---

4.2.1.1. Single Oven Placement Requirements

- Place oven on a solid foundation such as a bench top, an optional cabinet base, or directly on the floor.
- Allow at least two inches clearance at the rear of the oven to provide proper ventilation. The oven may be placed next to another cabinet or next to another oven, with three-quarters of an inch clearance. The doors will still open.
- Plumb and level the oven to assure proper heat distribution and operation of all mechanical components.
- Do not expose oven to excessive vibration and affix all electrical cabinets.
- If placing the oven in an area where excessive particulate matter exists (such as a construction site or a coal processing center), periodically clean all its electrical compartments. Keep the power supply within the specifications provided by Despatch, and use a line conditioner for a facility with an unstable power supply.

4.2.1.2. Multiple Oven Placement Requirement

- Stack up to two ovens vertically, with or without the optional framework supplied by Despatch.
- Use the holes in the rear oven feet to bolt the ovens together by removing the hole plugs in the top of the oven beneath.

4.2.2. Exhaust Connections

The RAD1-42-2E oven exhaust port is located on the rear of the oven. The exhaust port is covered by a hat bracket. For safety reasons, do not remove the hat bracket. Install an exhaust stack from the port to the outside of the building. Table 1 lists the requirements for the exhaust stack for the RAD1-42-2E oven.


	All stacks must comply with state and local building codes to insure that surrounding combustible surfaces are below 71°C (160°F).
---	---

Table 1. Exhaust Connection Requirements.

Requirements	RAD1-42-2E
Exhaust opening diameter (in) (cm)	2.5 6.4
Flashing through roof or wall must be capable of handling temperature of up to: (°C) (°F)	343 650

Use a minimum area greater than the area of the exhaust stack when using an exhaust stack. Design the exhaust stack to limit the amount of restrictions to ensure proper airflow. Over-all airflow will be reduced if more than two elbows are used in the exhaust stack.

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4.2.3. **Wiring & Power Connections**

See electrical schematics in Section 8.3 for line connections.




The oven must be hardwired directly to the electric supply.




Danger!

All grounding and safety equipment must be in compliance with applicable codes, ordinances and accepted safe practices.


5. Operation

	<p>Users and operators of this oven must comply with operating procedures and training of operating personnel as required by the Occupational Safety and Health Act (OSHA) of 1970, Section 5 and relevant safety standards, and other safety rules and regulations of state and local governments. Refer to the relevant safety standards in OSHA and National Fire Protection Association (NFPA), Section 86 of 1990.</p>
---	--

5.1. Load Oven

	<p>Despatch Industries cannot be responsible for either the process or process temperature used, or for the quality of the product being processed. It is the responsibility of the purchaser and operator to see that the product undergoing processing in a Despatch oven is adequately protected from damage.</p> <p>Carefully following the instructions in this manual will help the purchaser and operator in fulfilling that responsibility.</p>
---	---

Avoid spilling on the heater elements or oven floor when loading the oven. Do not place the load on the oven floor plate. Placing the load on the oven floor may cause the load to heat unevenly, and the weight may cause shorting out of the heater elements. Use the shelves provided.

	<p>Caution!</p> <p>Always place loads on the shelves provided to avoid possible uneven heating and damage to the oven.</p>
---	--

The two shelves are designed to be pulled out about halfway without tipping. Do not overload the shelves. Shelf support capacity is listed in the Capacities section (1.5.2). Do not overfill your oven. Distribute the workload evenly so airflow is not restricted. The workload should not take up more than two-thirds of any dimension of the inside cavity.

5.2. Pre-Startup Checklist

- Know the system. Read this manual carefully and make use of its instructions and explanations. Safe, continuous, satisfactory, and trouble-free operation depends primarily on

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your degree of understanding of the system and your willingness to keep all parts in proper operating condition.

- Check line voltage. Voltage must correspond to nameplate requirements of motors and controls. A wrong voltage can result in serious damage. Refer to Section 1.5.4 for more information.
- Check fresh air and exhaust openings. Do not be careless about restrictions in and around the fresh air and exhaust openings and stacks. Refer to Sections 1.5.2 and 4.2.2 for information on exhaust specifications and requirements. Under no condition can they be permitted to become so filled with dirt that they reduce airflow.
- An exhaust opening in the rear of the unit is covered by a hat bracket. Do not remove the hat bracket as it protects the exhaust opening from being completely covered.
- For drying ovens, open the vent to prevent buildup of moisture.
- For sample heating, close the vent when no ventilation is required.



Warning!

Do not use flammable solvent or other flammable material in this oven. Do not process closed containers of any substance or liquid in this oven because they may explode under heat.

5.3. Operating Procedure

5.3.1. Start Oven

For fastest oven heat-up time, close the fresh-air vent. After reaching the desired temperature, adjust the vent as needed.



If your oven is equipped with a Disconnect Switch, turn it to ON before starting the fan.


1. Start the fan.
 - a. Open oven door.
 - b. Set **POWER** to ON. You will hear the sound of the recirculating fan starting.
 - c. Shut oven door.
 - d. Check that the control display turns ON.
2. Operate the temperature control as desired.

5.3.2. Working with Protocol 3 Operating Modes

Refer to the Protocol 3 Controller Owner's Manual for specific information on working with the controller.

6. Maintenance

Do not attempt any service on this oven before opening the main power Disconnect Switch.

	<p><i>Danger!</i></p> <p><i>Disconnect all power sources before making repairs. Contact with energized electrical sources may result in serious injury or death.</i></p>
---	--

6.1. Checklist

- Keep equipment clean. Gradual dirt accumulation retards airflow. A dirty oven can result in unsatisfactory operation such as unbalanced temperature in the work chamber, reduced heating capacity, reduced production, overheated components, and the like. Keep the walls, floor and ceiling of the oven work chamber free of dirt and dust. Floating dust or accumulated dirt may produce unsatisfactory work results.
- Keep all equipment accessible. Do not permit other materials to be stored or piled against it.
- Protect controls against excessive heat—particularly controls, motors or other equipment containing electronic components. Avoid temperatures greater than 51.5°C (125°F).
- Establish maintenance and checkup schedules. Do this promptly and follow the schedules faithfully. Careful operation and maintenance will be more than paid for in continuous, safe and economical operation.
- Maintain equipment in good repair and make repairs immediately to avoid costly delays.
- Practice safety. Make it a prime policy to know what you are doing before you do it. Make **caution**, **patience**, and **good judgment** the safety watchwords for the operation of your oven.

6.2. Lubrication

Fan motor bearings are permanently lubricated. Lubricate all door latches, hinges, door operating mechanisms, bearings and wear surfaces to ensure easy operation.


6.3. Replacement Parts

Contact the Service Products Division at Despatch to order or return parts. The Service Products features our Response Center for customer service. A Despatch representative will provide you with an MRA (Material Return Authorization) number that must be attached to the returned part for identification. When ordering a replacement part, be sure to give the model number, serial number, and part number to expedite the process. Contact the **Global Service Network at 1-800-473-7373** with any service needs.

6.4. Repairs

6.4.1. Protocol 3 Controller


Refer to the Protocol 3 Owner's Manual for instructions on replacing the Protocol 3 controller.

	<p>Danger!</p> <p><i>Disconnect all power sources before making repairs. Contact with energized electrical sources may result in serious injury or death.</i></p>
---	--

6.4.2. Heater Unit

Follow these guidelines to repair the RAD1-42-2E heater unit if necessary. Required tools:

- 3/8# wrench
- Square recess driver with #1 bit

	<p>Danger!</p> <p><i>Disconnect all power sources before making repairs. Contact with energized electrical sources may result in serious injury or death.</i></p>
--	--

Directions:

1. Disconnect power.
2. Remove left and right inside walls.
3. Remove chamber floor plate from oven.
4. Disconnect heater leads from heater element with wrench. Note which wires go on which terminals.
5. Unscrew screws holding heater frame to oven body.
6. Remove heater and discard.
7. Screw down new heater frame.
8. Attach heater leads to appropriate terminals.
9. Replace interior floor.
10. Replace inside walls.

6.4.3. Fan Motor

Follow these guidelines to repair the RAD1-42-2E fan motor if necessary. Required tools:

- Screwdriver
- 5/32 inch Allen wrench
- One quarter inch socket set

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Danger!

Disconnect all power sources before making repairs. Contact with energized electrical sources may result in serious injury or death.

Directions:

1. Remove left and right inside walls.
2. Remove chamber floor plate from oven.
3. Remove fan inlet plate.
4. Loosen set screws (2) on fan wheel.
5. Remove side access panel. This will reveal fan motor.
6. Remove fan motor.
 - a. Disconnect motor leads from circuit board.
 - b. Remove screws (4) holding motor to base.
 - c. Lift fan motor from oven body.³
7. Replace fan motor.
 - a. Insert shaft into shaft collar. Put fan wheel onto shaft from inside oven.
 - b. Reattach motor to motor base.
 - c. Reattach motor lead wires to circuit board.
8. Adjust fan wheel for 3/16 inch clearance between wheel and inlet ring.
9. Tighten set screws on fan wheel.
10. Check that set screws hit flats machined into motor shaft.
11. Replace chamber floor plate.
12. Replace left and right side walls.
13. Replace side access panel.

³After the fan wheel has run at temperature for a while, it will stick to the shaft. Some force may be required to separate the fan wheel from the fan motor shaft.

7. Troubleshooting


7.1. Possible Problems and Suggested Solutions

Equipment which operates for long periods of time may develop problems. Table 2 lists possible problems and suggested solutions. Table 3 shows how to troubleshoot the control panel mounted circuit board. If you have a problem not listed or have a question, contact Despatch Industries at our toll free **Help Line: 800-473-7373**.

Table 2. Possible Problems and Suggested Solutions.

Difficulty	Probable Cause	Suggested Remedy
Failure to heat or heats up to only 35-50°C	No power	Check power source and/or oven and wall fuses.
	Burned out heater	Replace heater (see Warranty, Section 8.1).
	Broken or frayed cord	Replace with new cord.
	Protocol 3 controller malfunction	Replace Protocol 3 controller.
	Loose wire connections	Disconnect power and check connections behind control panel.
	Heater relay failure	Replace circuit board.
	Door switch failure (if installed)	Replace door switch.
Slow heat up	Improperly loaded	Reduce load or redistribute load in chamber.
	Low line voltage	Supply sufficient power and proper connections. Check for circuit overload.
	Heating element(s) are burned out	Replace heater (see Warranty, Section 8.1).
	Fan motor failure	Replace fan motor.
Frequent heater element burnout	Harmful fumes generated by load	Increase vent opening or discontinue process.
	Spillage or splattering of material on heater elements	Disconnect power and clean oven chamber and elements.
	Overheating oven	Check the High Limit.

Difficulty	Probable Cause	Suggested Remedy
Erratic temp. or inaccurate temp	Protocol 3 controller malfunction	Replace Protocol 3 controller.
	Improper tuning parameters	Check tuning parameters.
	Protocol 3 controller miscalibration	Recalibrate Protocol 3 controller (see Protocol 3 Controller Owner's Manual for further instruction).
	High Limit setting	High Limit should be 10-25°C higher than setpoint.
	Improper offset	Check zone calibration.
Excess surface or door temp.	Door seal deterioration	Replace door seal.
Improper airflow	Fan motor failure	Replace fan motor.
	Fan wheel seated too low on fan shaft	Adjust fan wheel for 3/16" clearance between wheel and inlet ring.
	Unbalanced fan wheel	Replace fan wheel.
Excessive vibration	Dirty fan wheel	Clean fan.
	Unbalanced fan wheel	Replace fan wheel.
Oven will not control at setpoint	High Limit set too low	Set the High Limit higher.
	Protocol 3 controller malfunction	Replace Protocol 3 controller.
	SSR malfunction	Replace SSR and/or check control output voltage.
	Air friction of recirculation fan	Open exhaust air vent. Unit will not control below minimum operating temperature with vent closed.
Heater does not shut down until temp. reaches the High Limit setting	Protocol 3 controller malfunction	Replace Protocol 3 controller.
	SSR malfunction	Replace SSR.



Danger!

Table 3 lists troubleshooting steps that must be performed by a qualified electrician or electrical technician trained on electrical safety and the use of personal protective equipment.

Table 3. Troubleshooting with Control Panel Mounted Circuit Board.

If LED is...			Check...
1 LED	2LED	3 LED	
Not Lit			Check Fuse Block 2F and 3F (Figure 5)
Lit	Not lit	Lit	<ul style="list-style-type: none"> • Check High Limit • Check optional door switch, if appropriate
Lit	Lit	Lit	<ul style="list-style-type: none"> • Check Fuse Block 1F and 4F (Figure 5) • Check SSR • Check heater • Check heater relays

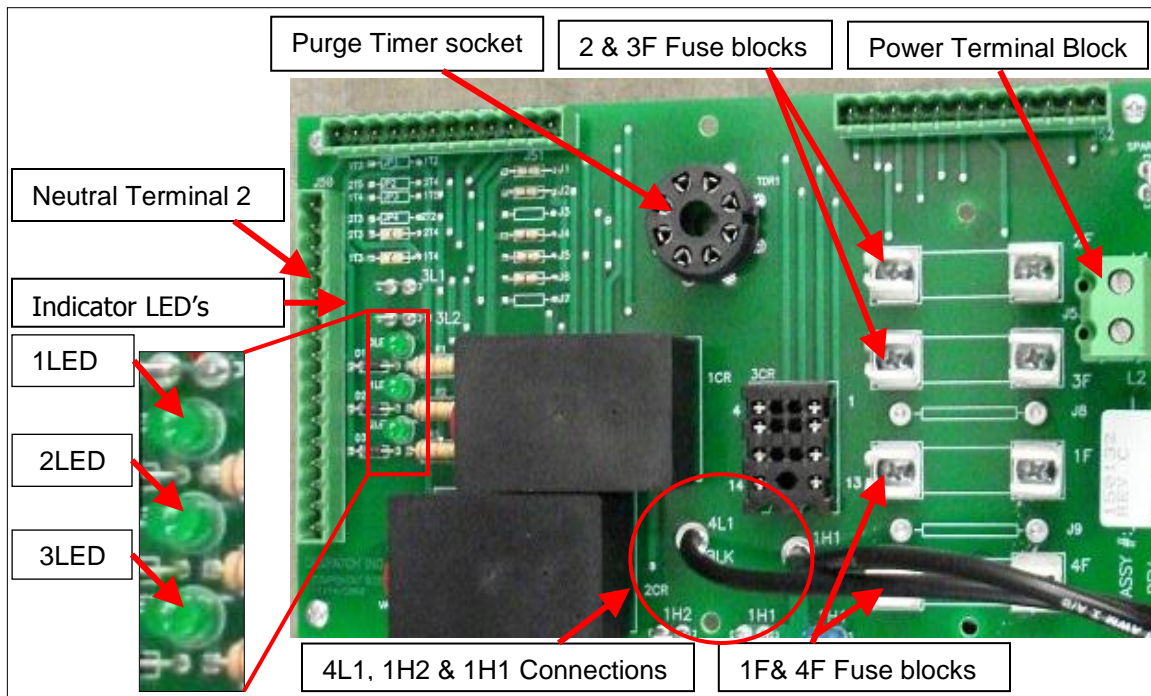


Figure 5. RAD1-42-2E LED Circuit Board Lights.



Danger!

Electrical panels contain high voltage. Turning the power switch off on the oven does not de-energize the circuit board. Disconnect and lock out the power supply before working on the circuit board. Failure to lock out the power supply can result in death or injury.

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7.2. Error Messages and Alarm


Table 4 lists the more common error messages, possible problems and remedies.

Table 4. Error Messages and Next Steps.

Alarm Status	Possible Problem	Next Step
HI LIMIT LED ON	<ul style="list-style-type: none"> • Problem with thermocouple • High Limit setpoint has been exceeded. 	Once the problem has corrected, press RESET .
DEV HOLD LED flashing	Oven temperature has not entered (or dropped out of) the Auto Hold band and the soak timer has stopped	Program a slower ramp rate or, if oven is not heating, check heater circuit.
Top PV displays OPEN	Control thermocouple is disconnected or broken	Repair or replace the thermocouple.
HLPV displays OPEN	High Limit thermocouple is disconnected or broken	Repair or replace the thermocouple.

8. Appendices

8.1. Standard Products Warranty



Despatch
INDUSTRIES

Standard Products Product Warranty

Products Covered by this Warranty

This warranty (the "Warranty") applies to the following Despatch products: LEB, LBB, LAC, LCC, LCD, LLC, LLD, RAD, RFD, LND, TAD, TFD, PN, PTC, PCC, 900 Series.

Parts and Materials

Despatch warrants all parts and materials to be free from defects in material and workmanship for a period of:

- five (5) years from date of shipment for laboratory oven electric heaters;
- three (3) years from date of shipment for Protocol Plus, Protocol 3 and DES 2000 temperature controllers; and
- one (1) year from the date of shipment, or 2,000 hours of operation, whichever occurs first, for all other components of products covered by this Warranty.

During the applicable Warranty period, Despatch will repair or replace, at Despatch's option, parts and materials covered by this Warranty.

Labor

During the first 90 days of the Warranty period, Despatch will pay labor costs incurred to remove defective parts and materials, and to reinstall repaired or replacement parts or materials; provided, however, that Despatch's obligation to pay such labor costs shall be subject to the limitation that the removal and/or reinstallation service must be performed by a Despatch-authorized technician from Despatch's worldwide network of factory-trained professionals at a location within the contiguous United States.

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:

- 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;
- if applicable, follows the Emergency Procedure set forth in this Warranty; and
- 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:

- 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);
- repair or replacement of parts or materials designed and intended to be expendable or consumable; refrigerants, filters, lamps;
- routine maintenance; or
- 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.

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Service
Phone 800-473-7373; International Phone 952-469-8230; Fax 952-469-8193
e-mail service@despatch.com; www.despatch.com

Please see reverse side for other service offerings BB7 (12/30/08)

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8.2. MRC5000 Setup (Optional)

	<p>Refer to instructions provided by the recorder manufacturer for more specific installation notes.</p>
---	---

Temperature is retransmitted to the MRC5000 recorder from the controller. To set up the recorder:

1. Ensure hardware jumper JU1 is in place for the 5 VDC setting (Refer to MRC5000 Manual included).
2. Move MODE to **PROG/TEST/CAL** to display **Prog**.
3. Press ▼ twice to display **Inps**. Move to each Parameter Code using ▼ or ▲. Adjust each Parameter Code using the settings in Table 5.
4. After adjusting all settings, move MODE to **RUN**. Display on both the recorder and controller should read the same.

Table 5. MRC 5000 Settings.

Parameter Code	Degrees C	Degrees F
Inps	17	17
Icor	0	0
diSP	On	On
dPOS	0	0
EUU ⁴	400	752
EUL4	0	32
ChUP	400	800 ⁵
ChLO	0	0
DFF	1	1

8.3. Electrical Schematics

The following pages contain electrical schematics for the RAD1-42-2E oven.

⁴ These values must match the settings **RetOutLo** and **RetOutHi** on the Protocol 3 Control page. For example, if **RetOutLo** is 32, **EUL** must read 32.

⁵ Change 0-400 chart paper to 0-800 chart paper. Depending on the equipment used, 0-600 paper may be used if the maximum temperature is 500 degrees F.

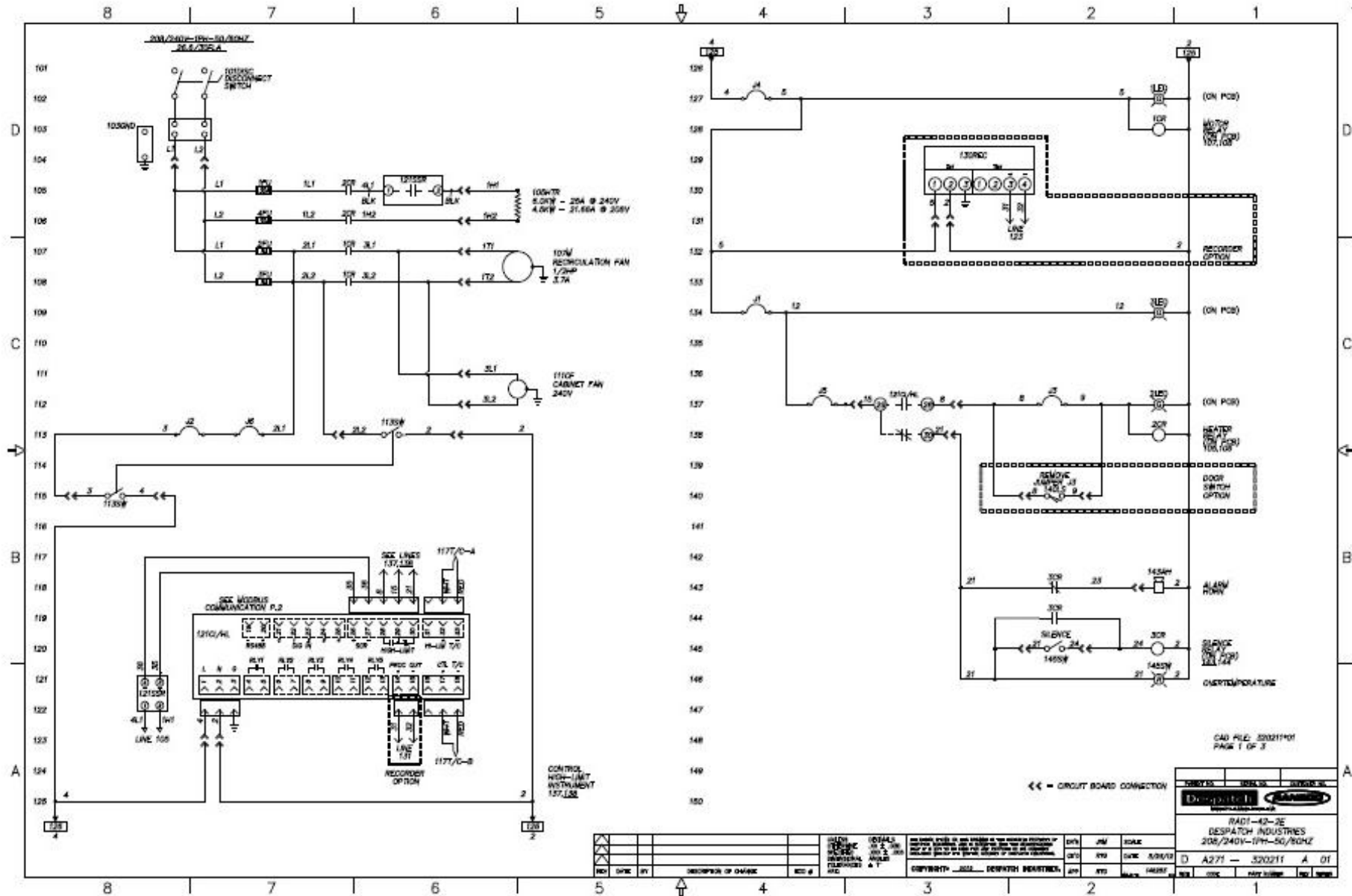


Figure 6. RAD1-42-2E (Drawing 320211-01).

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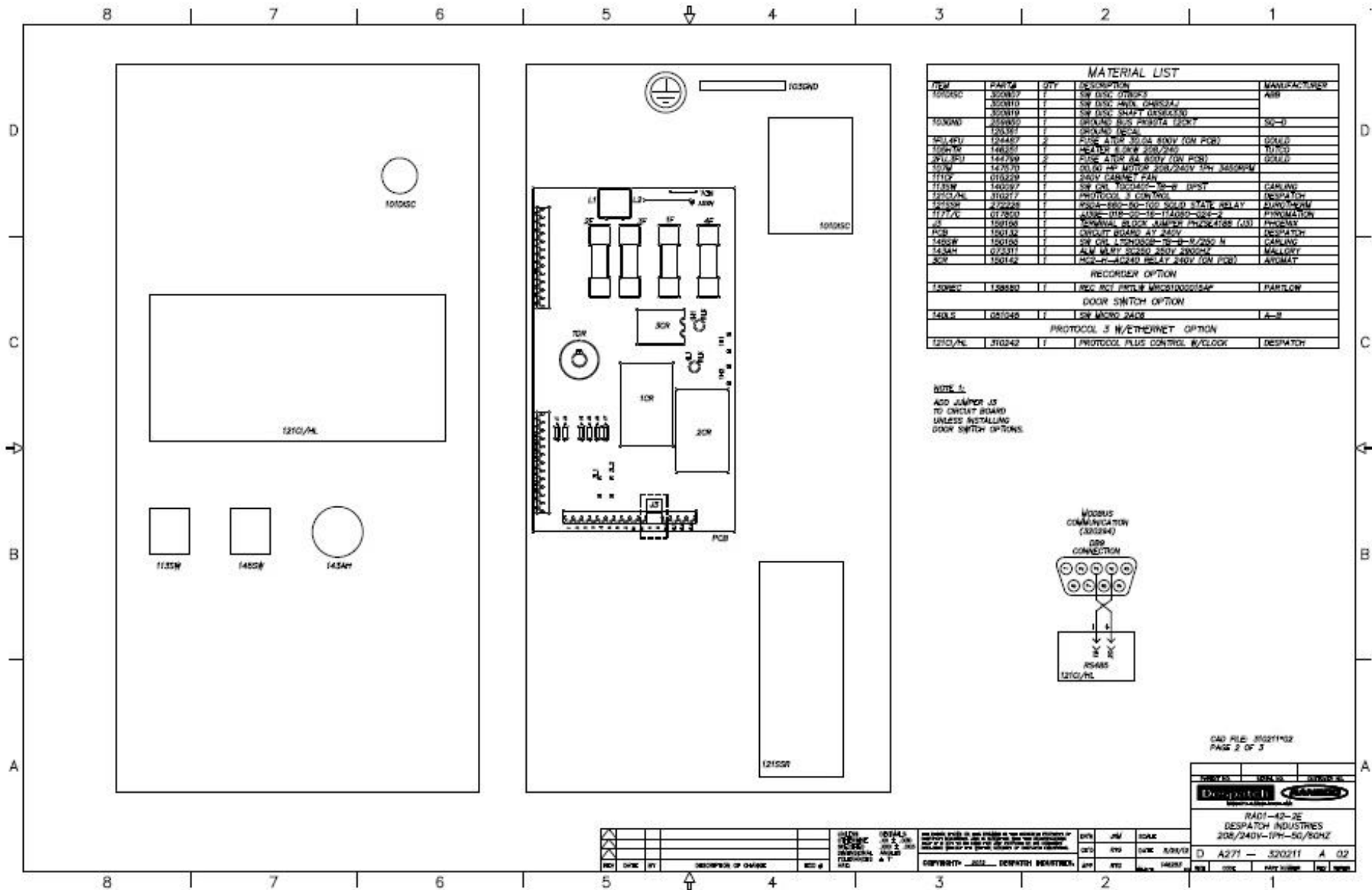


Figure 7. RAD1-42-2E (Drawing 320211-02).

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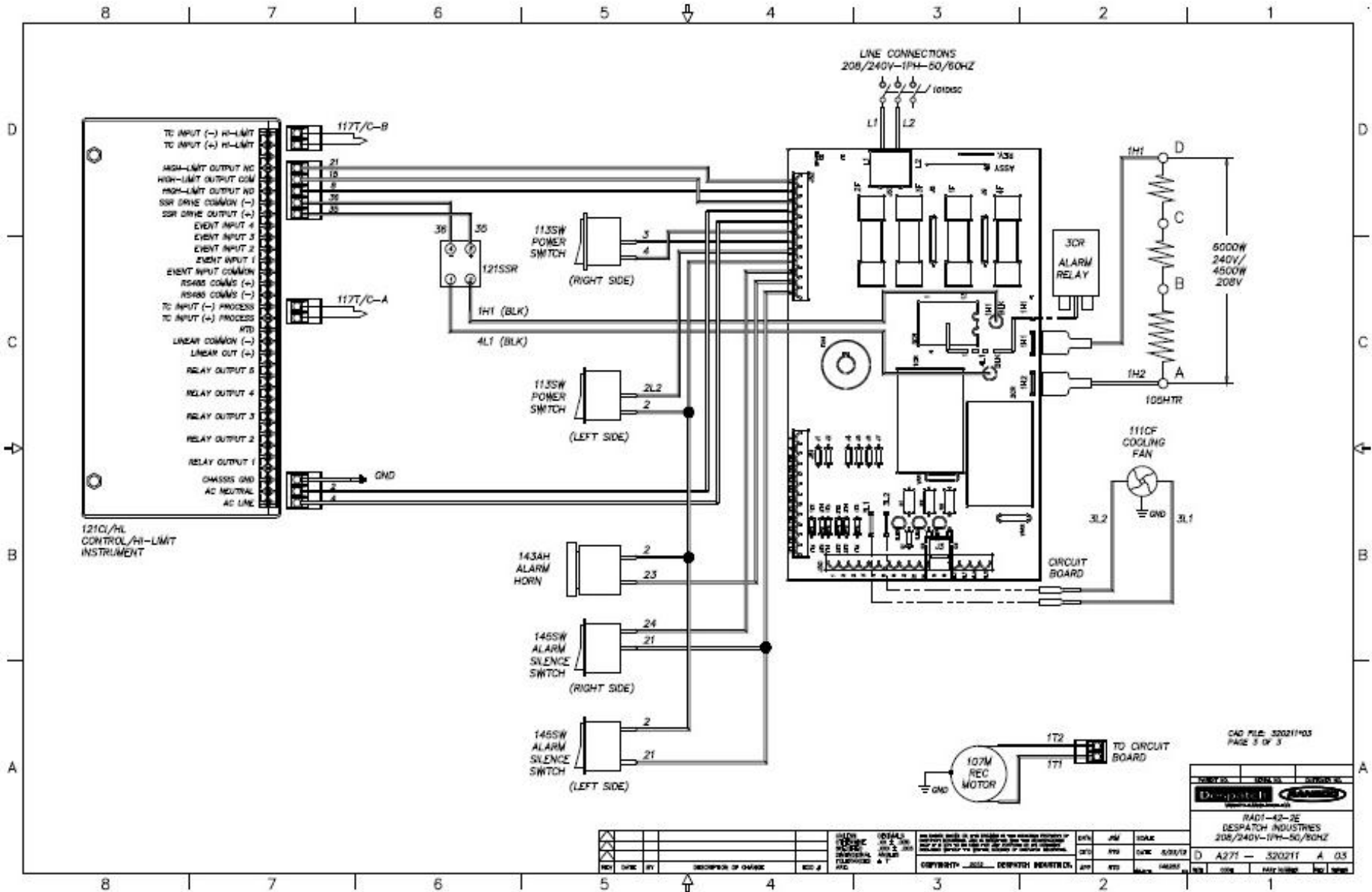


Figure 8. RAD1-42-2E (Drawing 320211-03).

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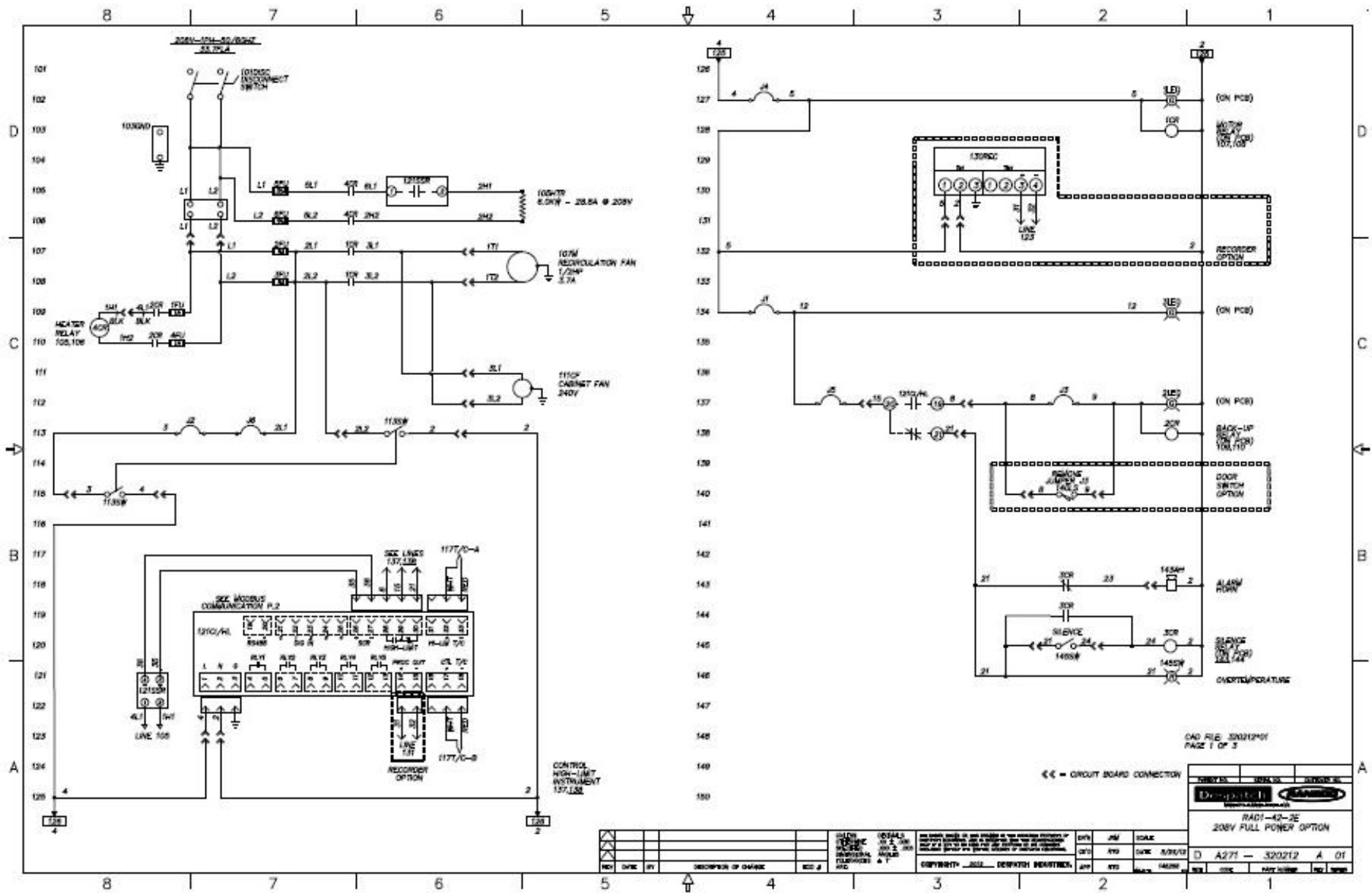


Figure 9. RAD1-42-2E (Drawing 320212-01).

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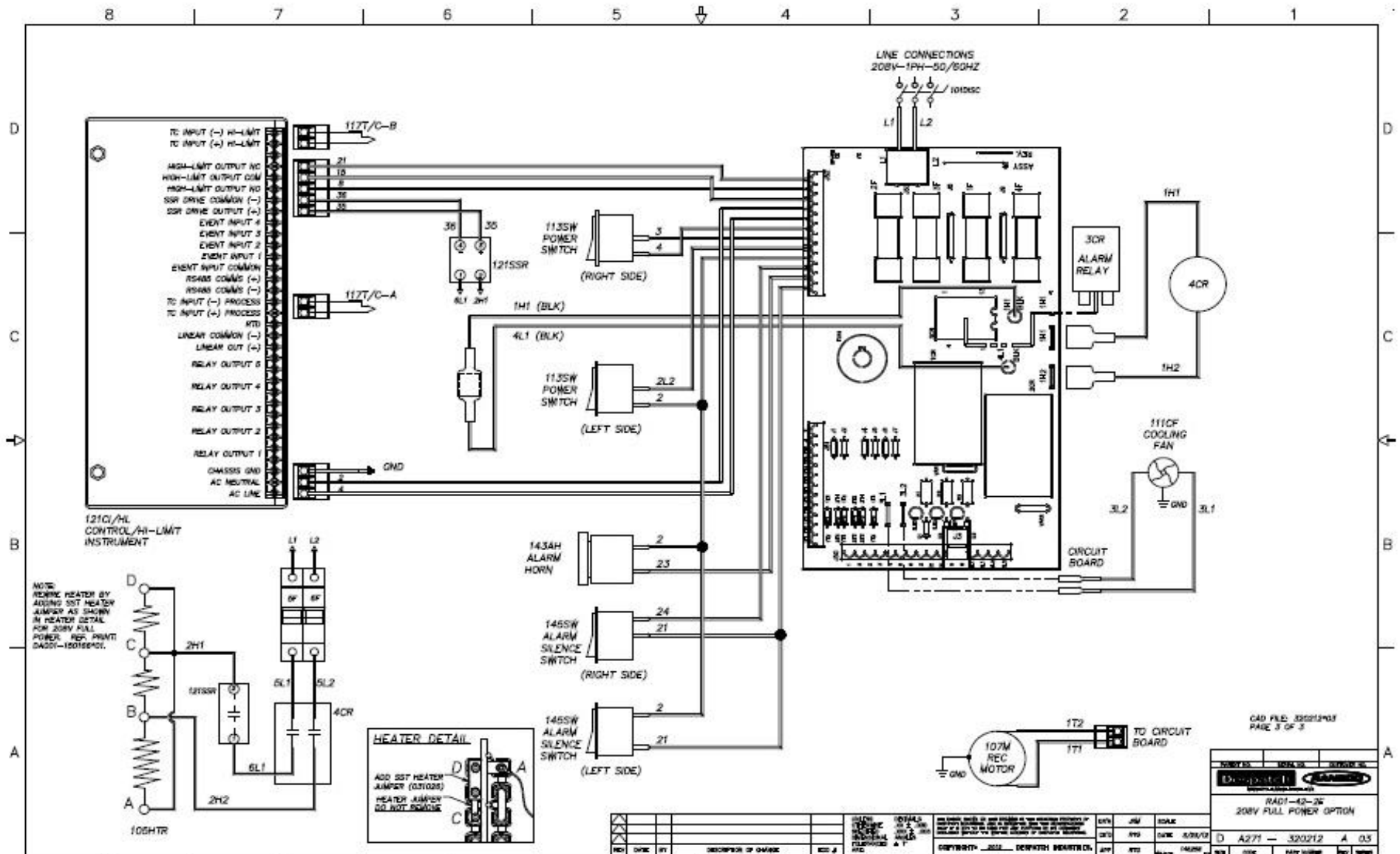


Figure 11. RAD1-42-2E (Drawing 320212-03).

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