ROTEM®
Control & Management

RTDC

Environmental Controllers for Tobacco Drying

Installation and User Guide

P/N: 110388

www.rotem.com

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Warranty & Limitation of Liability

1. ROTEM warrants that the product shall be free of defects in materials or workmanship and will conform to the technical specification for a period of 1 (one) year from the date of initial installation on site (the "warranty period").
2. ROTEM warrants that during said warranty period, any item/items or part/parts of equipment found defective with respect to materials or workmanship or which do not conform to the technical specification shall be repaired or replaced (at ROTEM's sole discretion), free of charge.
3. During the warranty period, in the event of an alleged defect, authorized resellers in relevant regions should be notified as soon as possible from the date of noticing the said defect, but no longer than thirty (30) days from such a discovery. The report shall include (1) a short description of the defects noticed (2) type of card / component and its matching serial number.
4. ROTEM's sole liability under this warranty is the repair or replacement of the defective item of product.
5. Load cells are not covered by ROTEM’s warranty.

Conditions and Limitations

1. ROTEM will not be responsible for any labor costs or expenses associated with replacement of defective items or other parts of the product or repair.
2. This warranty shall not cover: (i) product or part therein which has been modified (without prior written approval of ROTEM), or (ii) product or part therein which has not handled or installed by an authorized reseller of ROTEM or (iii) product or part therein which has either handled or installed not in strict accordance with ROTEM's instructions, (iv) products which were used for function other than agriculture industry.
3. This warranty will not apply in the following cases: (i) if all components of the product are not originally supplied by ROTEM (ii) the defect is the result of an act of nature, lighting strikes, electrical power surge or interruption of electricity (iii) the defect is the result of accident, misuse, abuse, alteration, neglect, improper or unauthorized maintenance or repair.

   ROTEM warns and alerts all users that the Product is inherently complex and may not be completely free of errors. ROTEM's products are designed and manufactured to provide reliable operation. Strict tests and quality control procedures are applied to every product. However, the possibility that something may fail beyond our control exists. Since these products are designed to operate climate control and other systems in confined livestock environments, where failure may cause severe damage, the user should provide adequate backup and alarm systems. These are to operate critical systems even in case of a ROTEM system failure. Neglecting to provide such a backup will be regarded as the user’s willingness to accept the risk of loss, injury and financial damage.

   In no event will ROTEM be liable to a user or any third party for any direct, indirect, special, consequential or incidental damages, including but not limited to any damage or injury to business earnings, lost profits or goodwill, personal injury, costs of delay, any failure of delivery, costs of lost or damaged data or documentation, lost or damaged products or goods, lost sales, lost orders, lost income.

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   Software Version: **1.08**

   Document Version: **1.1**

Table of Contents

1 FRONT MATTER

This section includes information on the manual and general information.

1.1 Introduction

Rotem manuals provide easy-to-use information regarding the installation, operation, long/short term planning and parts listing (this manual may not deal with all of the above subjects). The table of contents is an outline of the relevant information in this manual.

Read this manual before operating your Rotem product. Using this equipment for any other purpose or in a way not within the operating recommendations specified in this manual will void the warranty and may cause personal injury.

If you have any questions or comments regarding your product, please contact your local Rotem dealer.

1.2 Conventions

NOTE: Notes provide important details regarding specific procedures.

CAUTION **Cautions alert you to potential damage to the controller if the procedures are not followed carefully.**

WARNING! **Warnings alert you to potentially hazardous situations which, if not avoided could result in death or personal injury.**

1.3 Contact Information

Rotem Control and Management

Email: support@rotem.com
URL: www.rotem.com

1.4 Document Information

Revision History

Revision Level / Date	Section Affected	Description
1.0 November 2013		Release document
1.1 / April 2014		Added RTDC-8, new software

Document Number: 110388 **Revision Number: 1.1**

2 PRECAUTIONS

- Grounding
- Checking the Battery Level

2.1 Grounding

CAUTION	**Always connect temperature and sensor shields to earth ground. Avoid mixing high voltage wiring with sensor and low voltage wiring.**
CAUTION	**Keep the controller as far as possible from heavy contactor boxes and other sources of electrical interference.**
CAUTION	**Do not connect communication wire shields, which go from one house to another at both ends. Connect them at one end only. Connection at both ends can cause ground loop currents to flow, which reduce reliability.**

2.2 Checking the Battery Level

CAUTION	**Check the battery once a year. The output must be 2.7 volts (minimum). Authorized personnel only must replace the battery if the output is below the minimum required level or every five years.**

3 INTRODUCTION TO THE RTDC CONTROLLER

Rotem's RTDC controller enables growers to control the environment of their tobacco drying facilities. In particular, the RTDC provides control over air temperature and humidity. Growers can set the RTDC to monitor and control the temperature and humidity levels throughout the drying cycle, with these parameters changing as required. For example, when the relevant sensors detect that temperature or humidity levels are too low, the RTDC turns on the burner or shuts the air inlet, respectively.

- RTDC wets the leaves as needed to prepare them for shipping.
- In the event of temperatures going above permitted levels, an alarm is sent.

The RTDC supports:

- Analog sensors
  - One humidity sensor
  - Two temperature sensors
- Two digital sensors
  - Water Meter
  - Power Fail
  - Blower Fail
  - Fire / Smoke Detector
- RS-232 communication to a computer
- Four relays (RTDC-4) or eight relays (RTDC-8)

3.1 Relays

RTDC relays control:

- RTDC-4:
  - Relay 1: Burner
  - Relay 2: Inlet opening
  - Relay 3: Inlet closure
  - Relay 4: Blower \ Alarm \ Water Valve (user defined)
- RTDC-8:
  - Relay 1: Inlet Open
  - Relay 2: Inlet Close
  - Relay 3: Burner
  - Relay 4: Water Valve
  - Relay 5: Blower
  - Relay 6: Unused
  - Relay 7: Unused
  - Relay 8: Alarm

NOTE: Rotem recommends setting the relay switches to Auto.

3.2 RTDC Interface

Figure 1: RTDC-4 Front Panel

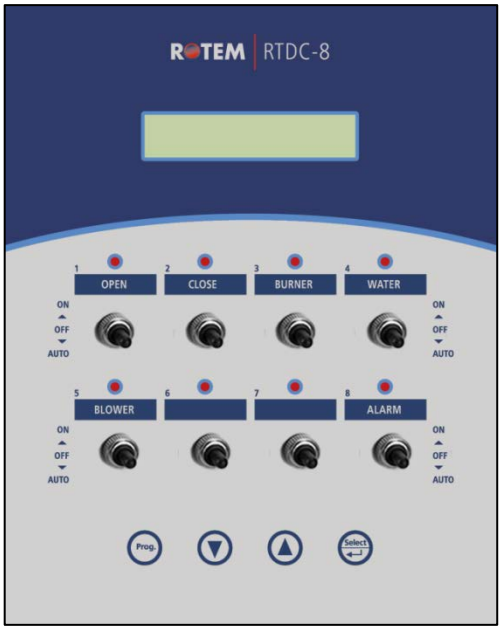

Figure 2: RTDC-8 Front Panel

3.2.1 RTDC Control Buttons

At the bottom of the RTDC screen are four buttons:

- Prog.
- Down (arrow)
- Up (arrow)
- Select

Press these buttons to scroll through screens, view data, enter and edit menus, and so on.

- To enter edit mode of a parameter, press **Prog**.
- To change the parameter, press **Up** or **Down**.
- To exit edit mode, press **Prog**.
- To cancel any change that you made while in edit mode, press **Select**.
- To go to the System menu, press **Prog** for three seconds.
- To turn off the alarm relay and keep it off for 30 minutes, press **Select** on any screen while an alarm is active. The alarm message remains on screen until the cause of the alarm is resolved.

3.2.2 Information Screens

When in the Main Menu, press the arrow keys to view the following information screens. **These screens are read only**.

- Climate conditions:
  - Current temperature and humidity
  - Target temperature and humidity

NOTE: When the unit is in Moisture mode, only the humidity specs appear. When the unit is in Cooling mode, only the temperature specs appear.

- Inlet information:
  - Current inlet position
  - Set inlet position
- Current control mode: Displays Curing, Cooling, Moisture, or Empty Barn.

3.3 Menu Structure

Control	Settings	Alarm	Test	System
Mode	Cure Temperature Increase	High Temperature Difference	Temperature Sensor 1/2	Curing Curve
Cure From Temperature	Cure Humidity Increase	Low Temperature Difference	Humidity Sensor	Relay 4
Cure To Temperature	Cure Time Per	Safety Temperature Alarm	Relay 1 - 8	Digital Input 1/2
Cure From Humidity	Burner On Difference	Safety Alarm Activity	Digital Input 1/2	Inlet Open
Cure Inlet Position	Burner Off Difference	Blower Alarm Activity	Software Version	Inlet Close
Cooling Temp	Auto Burner Recover	Reminder	Communiction Version	Communication Baud Rade
Cool Inlet Position	Burner Recover Tries		LCD Versiobn	Communication Unit ID
Moisture Humidity				

Some menu items depend on the setup or the model:

- **Control > Cure From/To Temperature, Cure From Humidity**: Only appear if Curve is enabled. When Curve is not enabled, Cure Temperature and Cure Humidity appear.
- **Settings > Cure Temperature Increase, Cure Humidity Increase, Cure Time Per**: Only appear if Curve is enabled.
- **System > Relay 4**: Appears in RTDC-4 only.

3.4 Theory of Operation

- Controlled Components
- Mode of Operation
- Alarms

3.4.1 Controlled Components

The RTDC controls the following components:

- **Burner Controller**: Each system includes a burner controller which regulates the burner (heater). The RTDC contols the burner controller, defining when the latter turns on and off.
- **Blower**: The blower ventilates the barn.
- **Inlet**: The inlet opens and closes to user-defined levels to control the temperature and humidity level.
- **Water valves**: These components wet the leaves before transport.

3.4.2 Mode of Operation

The RTDC operates in one of four modes. Each mode corresponds to a part of the tobacco drying cycle. In addition, the role that the temperature and humidity plays differs in each mode.

- **Curing**: In this mode, the air is kept hot and dry. Target temperature is set to be higher than the outside temperature while the humidity is kept lower. The burner raises the temperature to the target and then maintains it at this level while the inlet controls the humidity level. In this mode, the RTDC regulates the burner controller, blower, and inlet.
- **Cooling**: In this mode, the air temperature cools down to a user-defined temperature. Humidity does not play a role in this mode. The blower operates and the user opens the inlet. In this mode, the RTDC regulates the blower and inlet.
- **Moisture**: Before shipping the leaves, leaves are wet to prevent brittleness and breaking apart during transport. In this mode, the humidity is the critical specification. The humidity rises to a defined level and the inlet remains shut. In this mode, the RTDC regulates the inlet.
- **Empty Barn**. During this mode, the device is basically non-operational. Only a limited number of alarms are enabled. The inlet is shut completely.

NOTE: RTDC switches between modes **manually**; meaing the user changes the mode.

3.4.3 Alarms

Depending on the mode, different alarms are active.

- V: Alarm is enabled
- X: Alarm is disabled

Table 1: Mode Alarms

	Curing	Cooling	Moisture	Empty Barn	Shutdown procedure
High Temperature	V	X	X	X	X
Low Temperature	V	X	X	X	X
Safety Temperature	V	V	V	V	V
Temp Sens X Failure	V	V	V	X	X*
Hum Sens. Fail	V	V	V	X	V
Power Failure	V	V	V	V	X
Blower Failure	V	V	V	X	X
Smoke Detected	V	V	V	V	V
Fire Detected	V	V	V	V	V
Burner Recover Fail	V	X	X	X	X

Table 2: Alarm Messages

Message	Trigger	Siren	Communicator message
High Temperature	Sensor temperature average is greater than high temperature difference and target temperature in barn.	Yes	High temperature
Low Temperature	Sensor temperature average is lower than temperature difference and target temperature in barn.	Yes	Low temperature

Message	Trigger	Siren	Communicator message
Safety Temperature	Sensor temperature average is greater than the "safety temp alarm" value.	Yes	Saftey temperature
Temp Sens X Failure	Temperature sensor is disconnected \ shorted	Yes	Temp sensor X fail
Hum Sens. Fail	Humidity sensor is disconnected \ shorted	Yes	Humiditiy sensor fail
Power Failure	Digital Input 1/2 as assigned by user in System menu.	Yes	Power fail
Blower Failure	Digital Input 1/2 as assigned by user in System menu.	Yes	Blower in failure
Smoke Detected	Digital Input 1/2 as assigned by user in System menu.	Yes	Smoke detected
Fire Detected	Digital Input 1/2 as assigned by user in System menu.	Yes	Fire detected
Burner Recover Fail	Burner recovery attempts greater than the number of attempts specified in "Burner recover tries".	No	None

NOTE: Refer to Table 5, page 22 for details on the alarm settings.

4 RTDC FUNCTIONS

This section details how to use the RTDC.

- Initial Setup
- Curing Mode Configuration
- Cooling Mode Configuration
- Moisture Mode Configuration
- Empty Barn Mode Configuration
- Alarm Configuration
- Cold Start

4.1 Initial Setup

This procedure describes the initial unit configuration.

1. Press **Prog** for three seconds.
2. Press **Down**.Communication Speed. Press **Prog**.
3. If required, set the speed (9600 bps default). Press **Prog**.

NOTE: Rotem recommends a communication speed of 9600 or lower.

4. Press **Down**. *Comm ID* appears.
5. Press **Prog**.
6. Press **Up** to set the unit ID.

CAUTION Each unit MUST have a unique ID.

7. Press **Prog**.
8. **RTDC-4 only**:
    a. Go to Relay 4.
    b. Define the relay and press Prog.
9. Press **Select**.

4.2 Curing Mode Configuration

The following section describes how to configure the RTDC Curing Mode. Configuring the heat control consists of :

- Enabling/Disabling the Curve
- Setting the Temperature and Humidty Control
- Setting the Inlet Opening
- Setting Burner Differentials

➲ **Before starting, go to the Control Menu and select Cure Mode.**

4.2.1 Enabling/Disabling the Curve

RTDC controls the temperature and humidity in one of two manners:

- **Without a curve**: In this scenario, the user defines a target temperature and humidity. If either parameter does not meet the specification, RTDC turns on the burner or opens the inlet to adjust the temperature or humidity, respectively.
- **With a curve**: In this scenario, the user defines a target temperature and humidity **range**. When either parameter falls out of this range, the RTDC turns on the burner or opens the inlet and adjusts the parameters **gradually**, at a user defined rate (cure increase/cure decrease respectively).

1. Press **Prog** for three seconds; *System* appears.
2. Press **Up** or **Down** until *Curve* appears.
3. Press **Prog**.
4. Set the Curve to *Yes* or *NO*, as required.
5. Press **Prog**.
6. Press **Select**.

4.2.2 Temperature and Humidty Control

- If there is no curve, set temperature and humidty targets.
- If there is a curve, set temperature and humidty curves.

4.2.2.1 Setting Targets

This procedure details how to set the target temperature and humidity. When set:

- The burner turns on when the temperature falls below this temperature.
- The inlet opens to the user defined position.

NOTE: If you want the burner to turn on (or turn off) at a specific temperature below the Target Temperature, refer to Setting Burner Differentials.

➲ **Curve must be disabled.**

1. Press **Select**
2. Scroll to Control and press **Prog**.
3. Scroll to Cure Temperature and press **Prog**.
4. Press **Up** or **Down** to set the required temperature.
5. Press **Prog**.
6. Scroll to Cure Humidity and press **Prog.**
7. Press **Up** or **Down** to set the required humidity level and press **Prog.**
8. Scroll to Cure Inlet position and press **Prog.**
9. Press **Up** or **Down** to set the inlet opening and press Prog.
10. Press **Select**.

4.2.2.2 Setting Ranges

This procedure details how to set a temperature and humidity curve.

➲ **Curve must be enabled.**

1. Press **Select**.
2. Scroll to Control and press **Prog**.

3. Scroll to Cure From Temperature and press **Prog**.
4. Press **Up** or **Down** to set the required temperature and press **Prog**.
5. Scroll to Cure to Humidity and press **Prog**
6. Press **Up** or **Down** to set the required humidty and press **Prog**.
7. Press **Select**.
8. Scroll to Settings and press **Prog**.
9. Scroll to Cure Temperature Increase and and press **Prog**.
10. Press **Up** or **Down** to set the required temperature increase and and press **Prog**..
11. Scroll to Cure Humidity Decrease and and press **Prog**.
12. Press **Up** or **Down** to set the required humidty decrease and and press **Prog**..
13. Scroll to Cure Time and press **Prog**.
14. Press **Up** or **Down** to select the required time and press **Prog**.
15. Press **Select**.

4.2.3 Setting the Inlet Opening

1. Scroll to Cure Inlet position and press **Prog.**
2. Press **Up** or **Down** to set the inlet opening and press **Prog**.
3. Press Select.
4. Scroll to System and press Prog.
5. Scroll to Inlet Open and press Prog.
6. Set the inlet opening time and press Prog.
7. Press the down arrow and press Prog.
8. Set the inlet closing time and press Prog.
9. Press Select.

4.2.4 Setting Burner Differentials

This procedure details how to set a temperature differential which turns the burner on or off at a temperature lower than the target temperature. For example, if:

- Target Temperature is set to 98°
- Burner On Differential is 5°
- Burner Off Differential is 2°

the burner turns on at 93° and turns off at 96°.

NOTE: Heat differential affects heating using a Target Temperature or a Temperature Curve.

1. Press **Select** and **Up** for three seconds to access Settings.
2. Press **Up** or **Down** until you reach *Burner On Diff* and press **Prog**.
3. Set the differential and press **Prog**.
4. Press **Up** or **Down** until you reach *Burner Off Diff* and press **Prog**.
5. Set the differential and press **Prog**.
6. Press **Up** or **Down** until you reach Auto Burner Recover.
    - No: Burner remains on regardless of the temperature (press **Prog** and then **Select**).
    - Yes: If the burner turns off, it attempts to reignite (proceed to step 7).
7. Press **Prog**.
8. Press **Up** or **Down** until you reach Burner Recovery Tries and press **Prog**.
9. Set the number of attempts and press **Prog.**

CAUTION **If one parameter is set to 0, the second parameter must at least ±0.4 degrees.**

10. Press **Select**.

The burner differentials are set.

4.3 Cooling Mode Configuration

In Cooling Mode, RTDC reduces the air temperature, while adjusting the inlet opening.

1. Press **Select**.
2. Scroll to the Control Menu and press **Prog**.
3. Select *Cooling* and press **Prog**.
4. Press **Up** or **Down** until you reach *Cooling Temp* and press **Prog**.
5. Press the **Up** or **Down** until you reach the required temperature and press **Prog**.
6. Press **Down** once and press **Prog**.
7. Press the **Up** or **Down** until you reach the required inlet position.
8. Press **Prog**.
9. Press **Select**.

The Cooling Mode is set.

4.4 Moisture Mode Configuration

In Moisture Mode, the RTDC raises the humidity level to the required level.

➲ **In RTDC-4, Relay 4 must be set to Water Valve.**

1. Press **Select**.
2. Scroll to the Control Menu and press **Prog**.
3. Scroll to Moisture and press **Prog**.
4. Press **Up** or **Down** until you reach the required humidity.
5. Press **Prog**.
6. Press **Select**.

The Moisture Mode is set.

4.5 Empty Barn Mode Configuration

When the barn is not in use, set the RTDC to Empty Barn. All functions are disabled except for the following alarms:

- Saftey Temperature Alarm,
- Fire
- Smoke Detectors
- Power Fail

1. Press **Select**.
2. Scroll to the Control Menu and press **Prog**.
3. Scroll to Empty Barn and press **Prog**.

The Empty Barn Mode is set.

4.6 Alarm Configuration

This procedure configures the alarms

1. Install digital sensors as shown in Figure 5 (optional).
2. Press **Select**.
3. Scroll to Alarms.
4. Press **Prog**.
5. Set each alarm (refer to Appendix: Feature Parameters for details).

4.6.1 Resetting Alarms

This procedure details how to reset current alarms.

1. Press **Prog** and **Select** for three seconds.
2. Press **Prog**.
3. Press **Up** to select *Yes*.
4. Press **Prog**.
5. Press **Select**.

RTDC resets the alarms.

Because two alarms, Burner Recovery Fail and Safety Temperate, are so important, they each have a unique reset procedure.

4.6.1.1 Burner Recovery Fail Alarm Reset

1. Press Select.
2. Go to Control and press Prog.
3. Scroll to Auto Burner Recovery.
4. Switch from Yes to No and then to Yes.

4.6.1.2 Safety Temperature Alarm Reset

1. Go to *Alarms* > *Safety Alarm Active*.
2. Set to **No**.

Devices returns to activity.

3. Set parameter back to "**Yes**" to re-enable the alarm for next time.

4.7 Cold Start

Press **Select** + **Up** + **Down** while powering up the controller causes a Cold Start. All parameters in the controller revert to their defaults and the Inlet Close relay stays on for a minimum of 60 seconds.

NOTE: Do not perform a Cold Start unless directed to by a Rotem technician.

5 TECHNICAL SPECIFICATIONS

Input Power Voltage

One Phase 115 VAC
0.1 Amp, 60Hz

Relay Loads

4 x 5.0 Amps, 250 Volts

Analog Inputs

3 temperature inputs
1 humidity input
12 VDC for humidity
0.1 A

Digital Inputs

5 mA @ 5 Volts, Dry Contact
2 inputs

Operating Temperature Range: -10° to +50° C (14° to 125° F)
Enclosure: Water and Dust Tight
Fuses: Main fuse: 0.100 Amps, 250 Volts
Relay Fuse: 5 A

6 WIRING DIAGRAMS

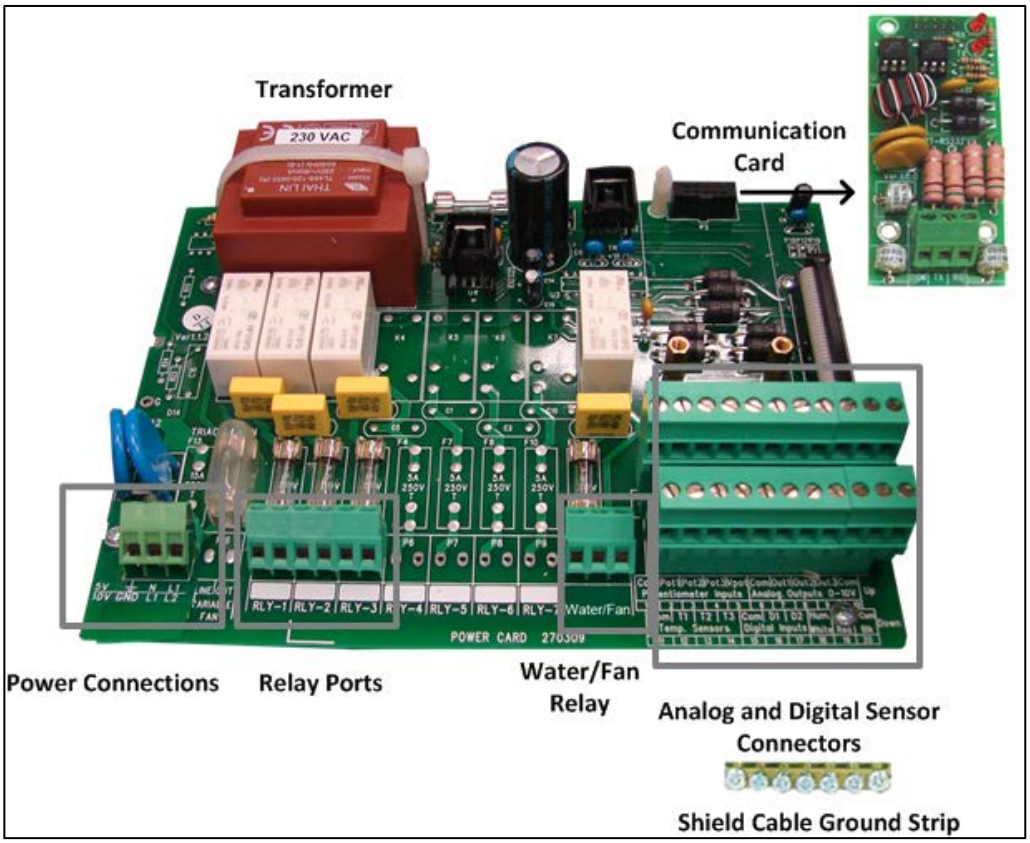

Figure 3: RTDC-4 Board Layout

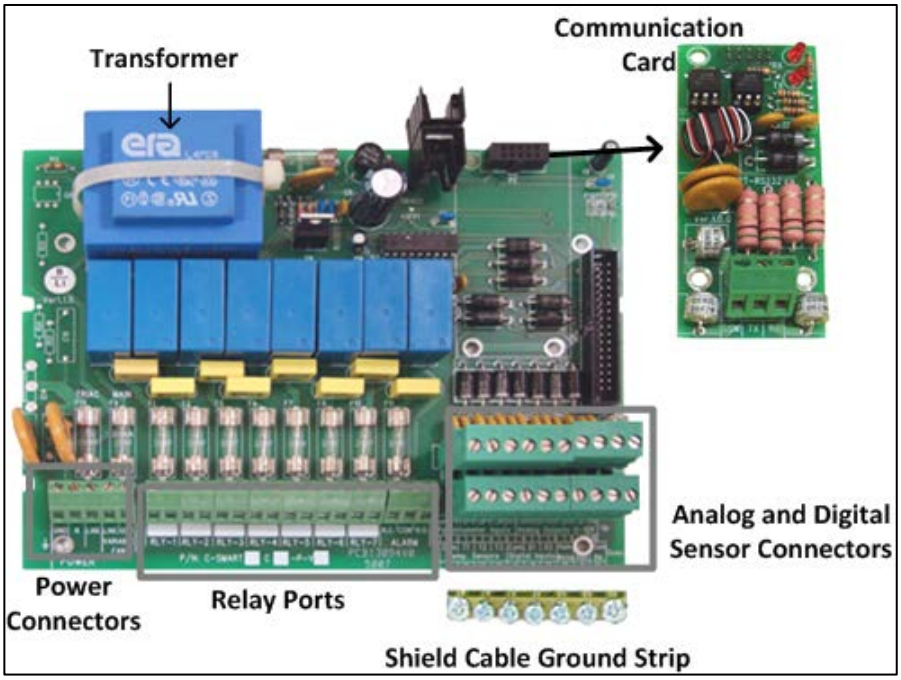

Figure 4: RTDC-8 Board Layout

Open the metal plate in a terminal before inserting a cable, as illustrated in Terminal 5.

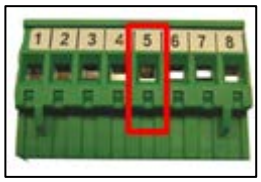

Figure 5: Opening a Port

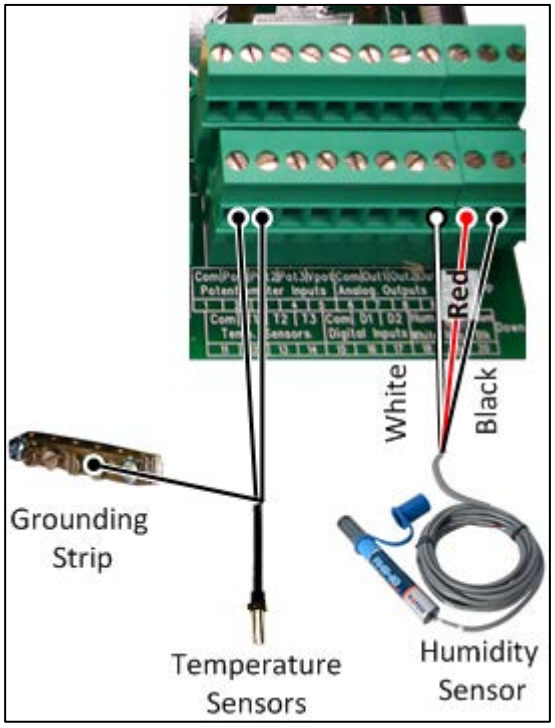

Figure 6: Analog Sensor Wiring

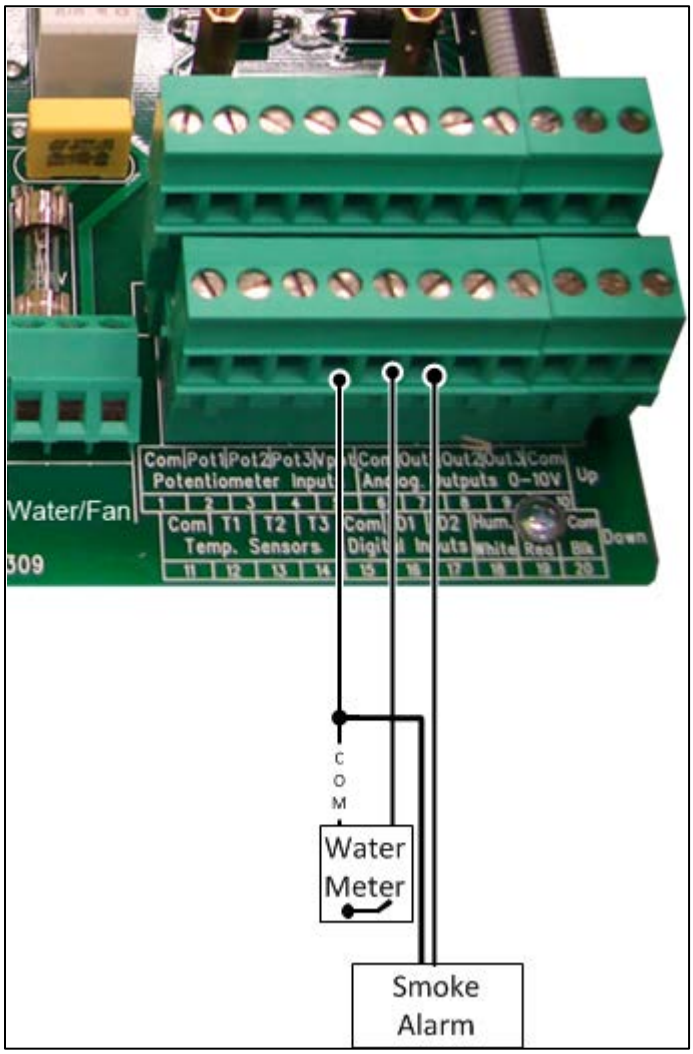

Figure 7: Digital Sensor Wiring (example)

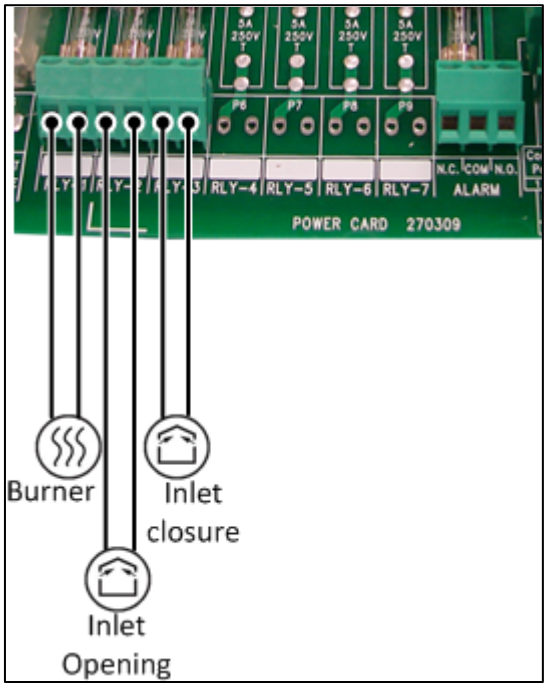

Figure 8: RTDC-4 Relay Wiring

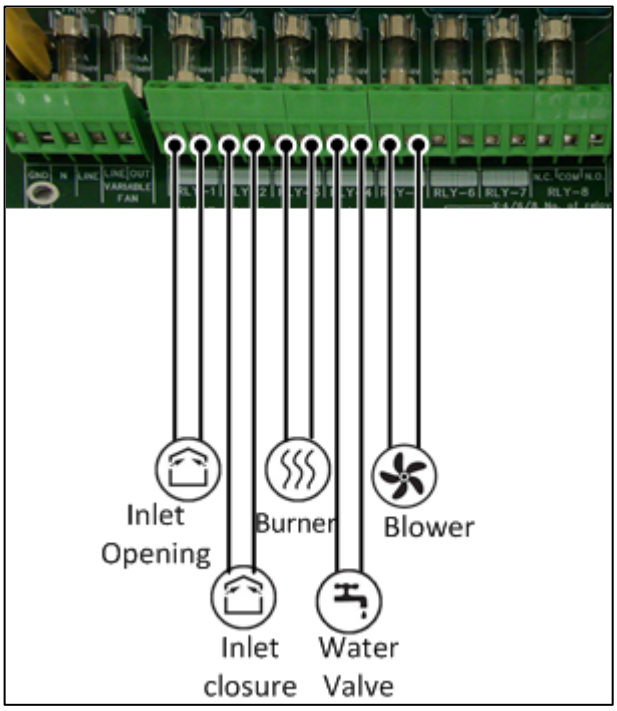

Figure 9: RTDC-8 Relay Wiring

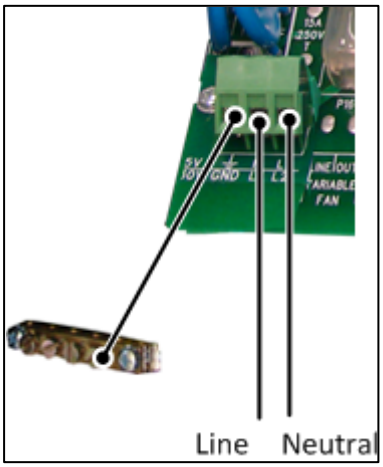

Figure 10: Powering the Unit

7 APPENDIX: FEATURE PARAMETERS

Table 3: Control Menu Items

Parameter Name	Default Value	Increment Value	Min Value	Max Value
Curve Enabled				
Control Mode	Curing	N/A	Curing, Cooling, Moisture, Empty Barn	
Cure From Temp	100.0	0.1	50.0	Cure to Temp
Cure to Temp (°)	120.0	0.1	Cure From Temp	180.0
Cure From Humidity (%)	85	1	100	Cure to Humidity
Cure to Humidity	15		Cure From Humidity	0
Curve Not Enabled				
Cure Temperature	100.0	0.1	50.0	180.0
Cure Humidity	85	1	0	100.0
Common Paramenters				
Cure Inlet Position (%)	25	1	0	100
Cooling Temp	90.0	0.1	50	180
Cool Inlet Position (%)	100	1	0	100
Moisture Humidity (%)	25	1	0	100

Table 4: Setting Menu Items

Parameter Name	Default Value	Increment Value	Min Value	Max Value
Cure Temp Increase	1	1	1	5
Cure Hum idity Increade	5	1	1	10
Cure Time Per (min)	60	N/A	15, 30, 45, 50, 55, 60, 65, 70, 75	
Burner On Diff	-3.0	0.1	-20.0	0.0
Burner Off Diff	1.0	0.1	0.0	20.0
Auto Burner Diff	Yes	N/A	Yes/No	
Burner Recovery Times	3	1	3	99

NOTE: Cure Temp Increase, Cure Hum idity Increade, and Cure Time Per (min) only appear when Curve is enabled.

Table 5: Alarms Menu Items

Parameter Name	Default Value	Increment Value	Min Value	Max Value
High Temperature Diff	10.0	1	0.0	99
Low Temperature Diff	-10.0	1	-99.0	0.0
Safety Temp Alarm	180	1	60	212
Safety Alarm Active	Yes	N/A	Yes/No	
Blower Alarm Active	Yes	N/A	Yes/No	
Reminder	30	1	0	99

Table 6: System Menu Items

Parameter Name	Default Value	Increment Value	Min Value	Max Value
Curing Curve	Yes	N/A	Yes/No	
Relay 4	Alarm	N/A	None, Blower, Alarm, Water Valve (RTDC-4 only)	
Digital-IN 1	Water Meter	N/A	None, Water Meter, Power Fail, Blower Fail, Fire / Smoke Detector	
Digital-IN 2	Power Fail	N/A	None, Water Meter, Power Fail, Blower Fail, Fire / Smoke Detector	
Inlet Open/Close	60	1	1	9999
Comm Baud Rate:	9600	N/A	115000, 19200, 9600, 4800, 2400	
Comm Unit ID	0	1	0	120