

UltraVac™

Controls for Modulating CORAYVAC® Infrared Heating Systems

Installation Manual



⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can result in death, injury or property damage. Read the Installation and Operation Manual thoroughly before installing or servicing this equipment.

Installation must be done by an electrician qualified in the installation of control systems for heating equipment.

Installer

Please take the time to read and understand these instructions prior to any installation. Installer must give a copy of this manual to the owner.

Owner

Keep this manual in a safe place in order to provide your serviceman with necessary information.



Quality in Any Language™

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TABLE OF CONTENTS

| | |
|--|-----------|
| SECTION 1: Introduction | 1 |
| 1.1 What is ROBERTS GORDON® ULTRAVAC™? | 1 |
| 1.2 CORAYVAC® Design Requirements | 1 |
| 1.3 General Requirements | 1 |
| 1.4 Check Installation Materials | 1 |
| 1.5 Carton Contents | 2 |
| 1.6 Safety | 5 |
| 1.7 Example Site Layout | 5 |
| SECTION 2: Specifications | 7 |
| 2.1 ROBERTS GORDON® ULTRAVAC™ Controller | 7 |
| 2.2 Temperature Sensors | 7 |
| 2.3 Variable Frequency Drive (VFD) | 9 |
| SECTION 3: Installation | 11 |
| 3.1 Preparation | 11 |
| 3.2 Positioning the ROBERTS GORDON® ULTRAVAC™ Controller and Variable Frequency Drive | 11 |
| 3.3 Cable Requirements: | 12 |
| 3.4 Electrical Installation Requirements | 13 |
| 3.5 Pump Requirements | 13 |
| 3.6 Variable Frequency Drive Requirements | 13 |
| 3.7 Indoor Sensor Placement | 14 |
| 3.8 Outdoor Sensor Placement | 14 |
| 3.9 Outside Air Supply | 14 |
| SECTION 4: Typical External Diagrams | 15 |
| SECTION 5: Communications | 20 |
| 5.1 Dedicated Phone Line for Central Controller Modem | 20 |
| 5.2 RS-485 Converter for Central Controller | 21 |
| 5.3 TCP/IP Communication Module | 22 |
| 5.4 Direct Connect | 24 |
| 5.5 Communications Between Multiple ROBERTS GORDON® ULTRAVAC™ Controllers | 25 |
| SECTION 6: Variable Frequency Drive Programming | 27 |
| 6.1 VFD Parameter Settings For Use With ROBERTS GORDON® ULTRAVAC™ | 27 |
| 6.2 Altering VFD Parameters | 28 |
| SECTION 7: Commissioning The CORAYVAC® System | 29 |
| 7.1 Setting The CORAYVAC® End Burner Vacuum | 29 |
| SECTION 8: Replacement Parts | 33 |
| 8.1 ROBERTS GORDON® ULTRAVAC™ Controller Replacement Parts | 33 |
| 8.2 Variable Frequency Drive Replacement Parts | 34 |
| 8.3 Replacement Parts Instructions | 35 |
| SECTION 9: Troubleshooting | 37 |
| SECTION 10: The ROBERTS GORDON® ULTRAVAC™ LIMITED Warranty | 41 |

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TABLE OF FIGURES

| | |
|--|----|
| Figure 1: Example Site Layout | 6 |
| Figure 2: ROBERTS GORDON® ULTRAVAC™ Controller Specifications | 8 |
| Figure 3: Variable Frequency Drive Components (Factory pre-wiring shown) | 10 |
| Figure 4: Controller Mounting..... | 11 |
| Figure 5: Indoor Sensor Cable Detail | 12 |
| Figure 6: Outdoor Sensor, VFD (0-10 V) Signal, RS-485 Communications Cable and Pressure Switch Cable Detail..... | 12 |
| Figure 7: Variable Frequency Drive Mounting | 13 |
| Figure 8: Indoor Sensor Mounting | 14 |
| Figure 9: Outdoor Sensor Placement | 14 |
| Figure 10: Central Controller Communication Equalization Wiring | 15 |
| Figure 11: ROBERTS GORDON® ULTRAVAC™ Central Controller External Wiring | 16 |
| Figure 12: ROBERTS GORDON® ULTRAVAC™ Satellite Controller External Wiring | 18 |
| Figure 13: Modem Location | 20 |
| Figure 14: RS-485 PC Connection..... | 21 |
| Figure 15: TCP/IP Communication Module Mounting..... | 22 |
| Figure 16: TCP/IP Communication Module Wiring..... | 23 |
| Figure 17: 9 Pin Adapter for PC | 24 |
| Figure 18: Communications Between Multiple Controllers..... | 25 |
| Figure 19: Repeater Wiring | 26 |
| Figure 20: End Vent Vacuum | 30 |
| Figure 21: Possible Damper Couplings' Locations..... | 31 |
| Figure 22: ROBERTS GORDON® ULTRAVAC™ Controller Components Diagram | 33 |
| Figure 23: Variable Frequency Drive Components Diagram ... | 34 |
| Figure 24: Troubleshooting Flow Chart | 37 |

SECTION 1: INTRODUCTION

1.1 What is ROBERTS GORDON® ULTRAVAC™?

The ROBERTS GORDON® ULTRAVAC™ is a micro-processor based control package designed for modulating control of CORAYVAC® heaters based on outdoor temperatures.

This controller is capable of giving control outputs to one vacuum pump and three heating zones. The controller also features inputs which are used for indoor and outdoor signal condition monitoring.

System status and settings are viewed and altered from a PC (not supplied) running ROBERTS GORDON® ULTRAVAC™ Software.

1.2 CORAYVAC® Design Requirements

CORAYVAC® burners shall be CRV B-6, B-8, B-9, B-10 or B-12 burners.

CORAYVAC® systems designed shall have **minimum** radiant pipe length and 1.5 - 2.0 feet per flow unit of tailpipe length.

-OR-

CORAYVAC® systems designed shall have **recommended** radiant pipe length and 1.2 - 1.5 feet per flow unit of tailpipe length. See the CORAYVAC® Design Manual (P/N 127500NA) for minimum and recommended radiant pipe length.

1.3 General Requirements

The ROBERTS GORDON® ULTRAVAC™ series of controllers are supplied pre-configured for use with ROBERTS GORDON® CORAYVAC® infrared heating equipment only. Failure to comply with the installation instructions and configuration may invalidate the ROBERTS GORDON® ULTRAVAC™ limited warranty. See Page 41, Section 10.

ROBERTS GORDON® ULTRAVAC™ Software requires a PC (not supplied) running Windows® 95 or higher, with a Pentium® class processor and at least 64k of RAM.

The controller, variable frequency drive, burners, pump and outside air blower must be electrically grounded in accordance with the National Electrical Code® ANSI/NFPA 70 - latest revision.

Before proceeding with the installation of the controller, it will be necessary to check that the following points have been considered.

1.4 Check Installation Materials

1.4.1 Switchable Loads

The controller relays are rated for switching loads no greater than 3 A. The total added current load for all 8 relays must not exceed 25 A.

1.4.2 Control Wiring

Shielded cable (four twisted pairs of stranded 24 AWG minimum wire) is required for use with indoor sensors.

Shielded cable (one twisted pair of stranded 22 AWG minimum wire) is required for the outdoor air sensor, VFD signal wiring, pressure switch and wiring from controller #1 to the PC.

Shielded cable (one twisted triad of stranded 22 AWG minimum wire) is required for RS-485 communications between controllers.

1.4.3 Control Board and Sensor Power

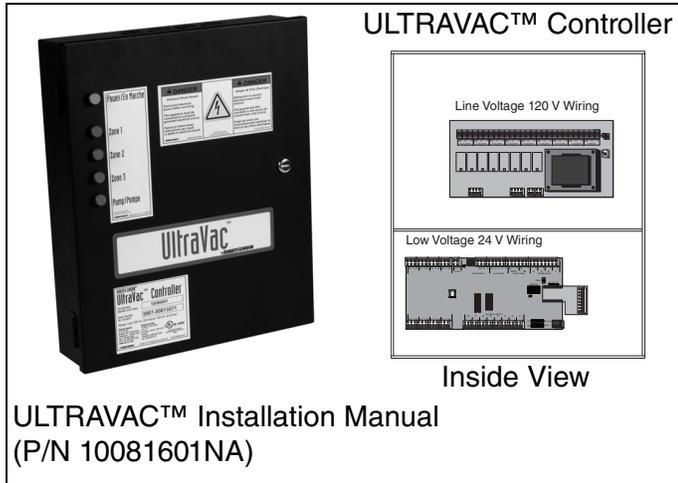
The power supply for all sensors is from the "+32 V" terminal to be found on the board of the controller. Power for the control board is 24 V provided by the relay board.

1.4.4 Programming Details

Every controller is pre-programmed for one pump and up to three heating zones. Use a site layout drawing to identify the heating zones.

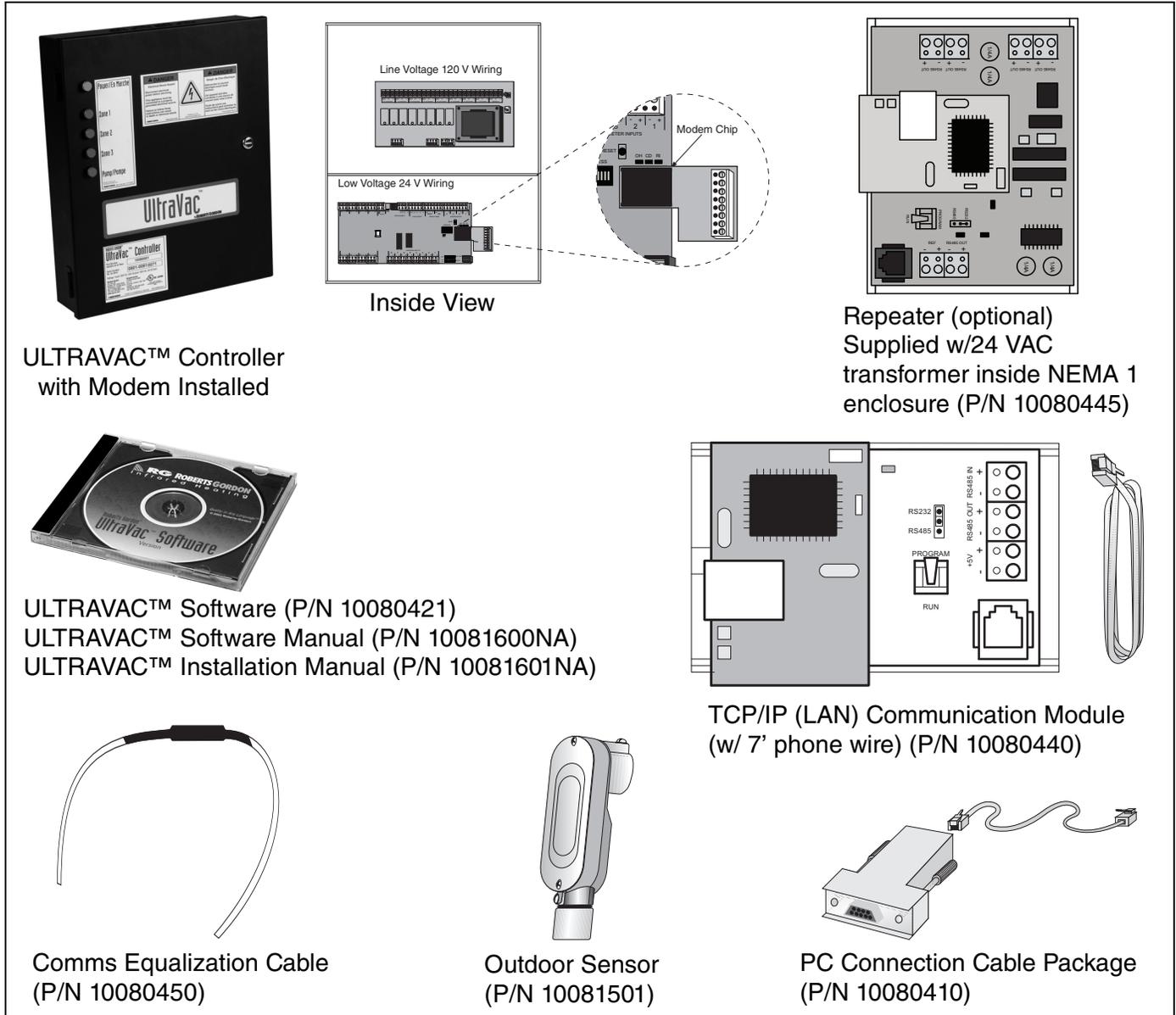
1.5 Carton Contents

URVSC: ULTRAVAC™ Satellite Controller



ULTRAVAC™ Installation Manual
(P/N 10081601NA)

URVCL: ULTRAVAC™ Central Controller with TCP/IP Communication Module

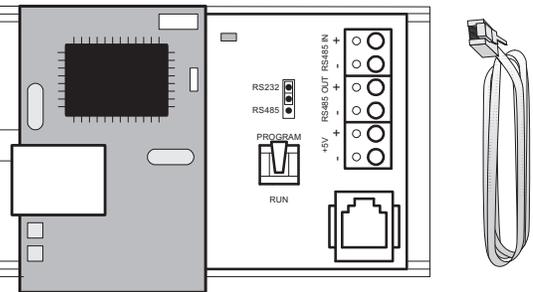


ULTRAVAC™ Controller
with Modem Installed



ULTRAVAC™ Software (P/N 10080421)
ULTRAVAC™ Software Manual (P/N 10081600NA)
ULTRAVAC™ Installation Manual (P/N 10081601NA)

Repeater (optional)
Supplied w/24 VAC
transformer inside NEMA 1
enclosure (P/N 10080445)



TCP/IP (LAN) Communication Module
(w/ 7' phone wire) (P/N 10080440)

Comms Equalization Cable
(P/N 10080450)

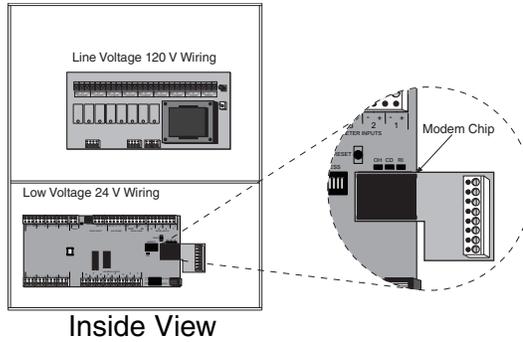
Outdoor Sensor
(P/N 10081501)

PC Connection Cable Package
(P/N 10080410)

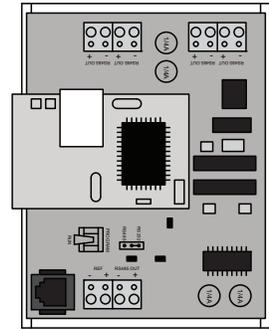
URVCCM: ULTRAVAC™ Central Controller with Modem



ULTRAVAC™ Controller
with Modem Installed



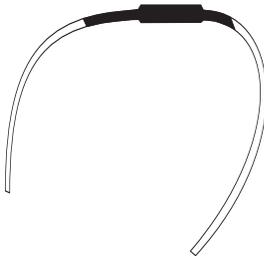
Inside View



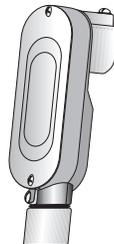
Repeater (optional)
Supplied w/24 VAC
transformer inside NEMA 1
enclosure (P/N 10080445)



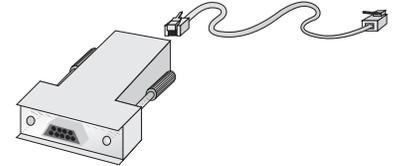
ULTRAVAC™ Software (P/N 10080421)
ULTRAVAC™ Software Manual (P/N 10081600NA)
ULTRAVAC™ Installation Manual (P/N 10081601NA)



Comms Equalization Cable
(P/N 10080450)



Outdoor Sensor
(P/N 10081501)

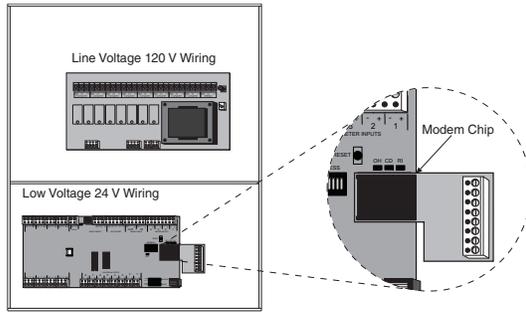


PC Connection Cable Package
(P/N 10080410)

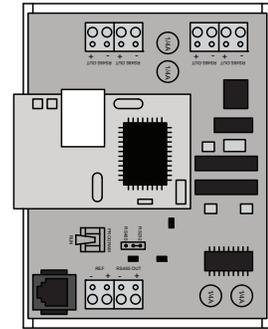
URVCCR: ULTRAVAC™ Central Controller with RS-485 Converter



ULTRAVAC™ Controller with Modem Installed



Inside View



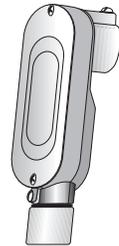
Repeater (optional)
Supplied w/24 VAC transformer inside NEMA 1 enclosure (P/N 10080445)



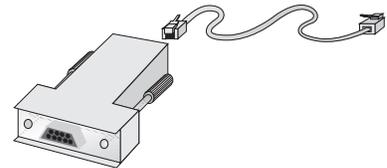
ULTRAVAC™ Software (P/N 10080421)
ULTRAVAC™ Software Manual (P/N 10081600NA)
ULTRAVAC™ Installation Manual (P/N 10081601NA)



Comms Equalization Cable (P/N 10080450)

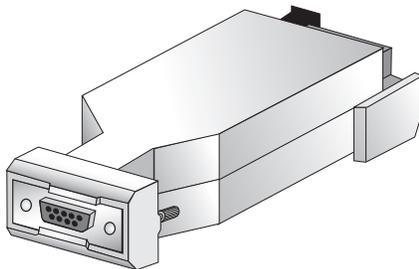


Outdoor Sensor (P/N 10081501)



PC Connection Cable Package (P/N 10080410)

RS-485 Converter Package (P/N 10080430)



RS-485 Converter



Power Supply

1.6 Safety



Your Safety is Important to Us!
This symbol is used throughout the manual to notify you of possible fire, electrical or burn hazards. Please pay special attention when reading and following the warnings in these sections.

Installation, service and annual inspection of controller must be done by an electrician qualified in the installation and service of control systems for heating equipment.

Installation, service and annual inspection of heater must be done by a contractor qualified in the installation and service of gas-fired heating equipment.

Read this manual carefully before installation, operation, or service of this equipment.

For optimum heater performance and safe heating conditions, inspect and maintain heater(s) before every heating season and as necessary. Also, know and maintain heater clearances to combustibles, see heater Installation, Operation and Service Manual for further details. If you require additional manuals, contact your ROBERTS GORDON® independent distributor or Roberts-Gordon at (716) 852-4400, (800) 828-7450 or at www.rg-inc.com.

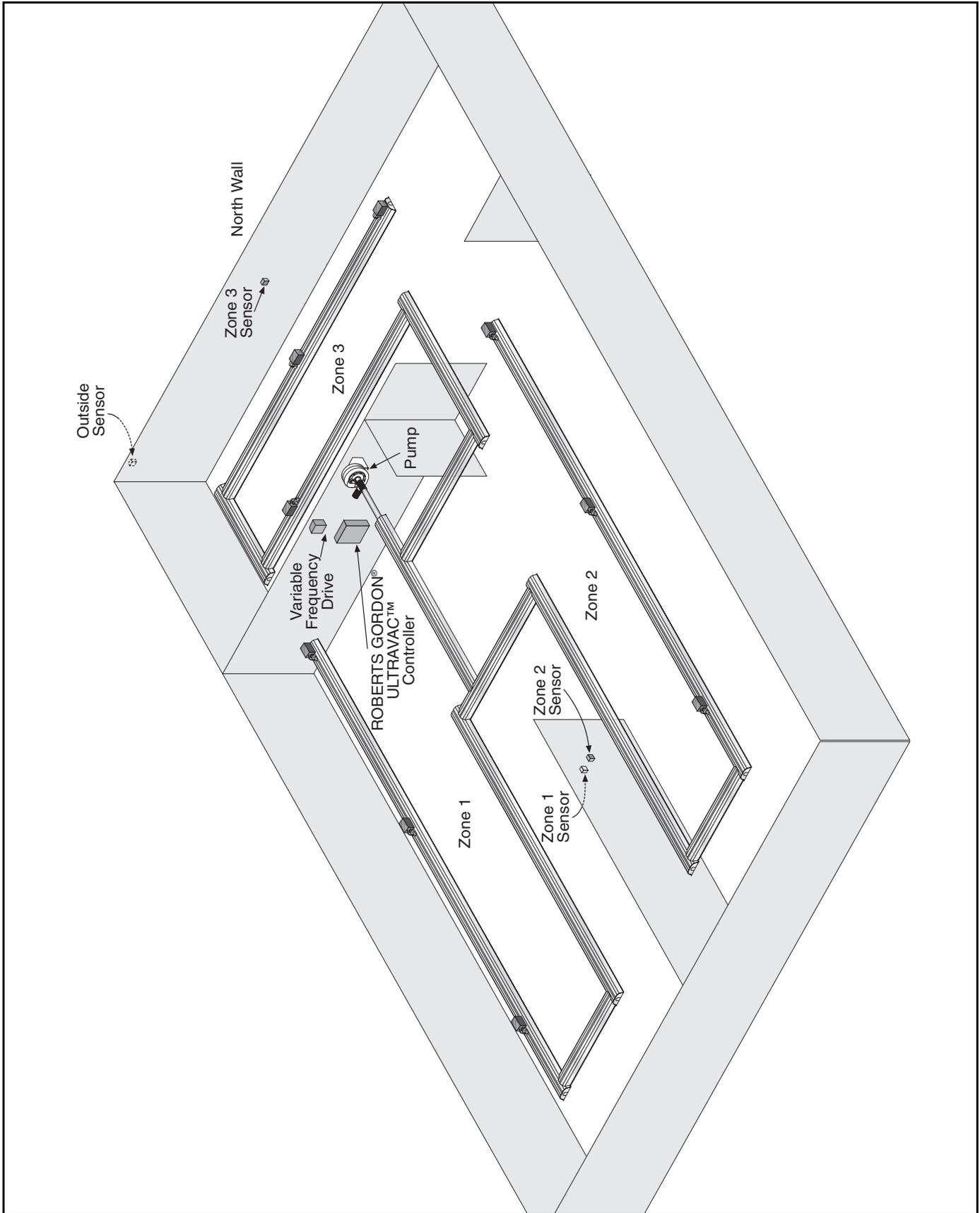
1.6.1 Manpower Requirements

To prevent personal injury and damage to the controls, two persons will be required for installation.

1.7 Example Site Layout

Page 6, Figure 1 is an example layout for a building where ROBERTS GORDON® ULTRAVAC™ will be used to control the infrared heating systems shown. The layout consists of three zones of ROBERTS GORDON® ULTRAVAC™.

FIGURE 1: Example Site Layout



NOTE: Conceptual drawing, not to scale. Venting not shown.

SECTION 2: SPECIFICATIONS**2.1 ROBERTS GORDON® ULTRAVAC™ Controller**

Wiring: Shielded Cable, one twisted pair, 22 AWG min.

2.1.1 Enclosure**Standard Enclosure**

Construction: 16 gauge painted steel, hinged door, removable knockouts provided.

Dimensions: 14.7" w x 17.7" h x 3.5" d

NEMA 4 Enclosure (P/N 10080302)

Description: NEMA 4 enclosure is sold separately as an option. ULTRAVAC™ Controller in standard enclosure is field mounted inside the NEMA 4 enclosure.

Construction: 14 gauge painted steel, hinged door with 19" x 16" window.

Dimensions: 24" w x 24" h x 9" d

Protection

Rating: NEMA 4/12

2.1.2 Electrical - Control Board

Power Supply: 24 V 60 Hz
(from relay board)

Analog Inputs: Sensor (thermistor), BMS enable
(dry contact)

Relay Outputs: 24 Vac

Analog Outputs: 0-10 Vdc

Digital Inputs: Timed, dry contact

Network Ports: RS-485, RS-232

UL Standard: UL 916 / C22.2 No. 205-M1983

2.1.3 Electrical - Relay Board

Power Supply: 120 V (+/- 10%) 1 Ø, 60 Hz

Inputs: 24V AC

Relay Outputs: Single Pole 3 A 120 Vac

UL Standard: UL 916 / C22.2 No. 205-M1983

2.2 Temperature Sensors**Indoor Sensor**

Dimensions: 2.75" w x 4.5" h x 1.15" d

Power: 32 V DC

Features: LCD temperature display, setpoint adjustment, override button

Wiring: Shielded Cable, four twisted pairs, 24 AWG min.

Outdoor Sensor (P/N 10081501)

Dimensions: 1.4" w x 5.3" h x 2" d

Enclosure: NEMA 4 gasketed aluminum LB housing, ½" threaded connection

NEMA 4 Enclosure for Indoor Sensor (P/N 10081510)

Description: NEMA 4 Enclosure is sold separately as an option. The indoor sensor is field mounted inside the NEMA 4 enclosure. Temperature thermistor and LCD temperature display will not operate properly inside the enclosure. LCD display feature should be disabled and use of the NEMA 4 sensor enclosure will require the use of an outdoor sensor (P/N 10081501) in the space to monitor zone temperature.

Dimensions: 6.3" x 3.6" x 1.8"

Construction: Polycarbonate enclosure with clear front cover, 4 screw cover closure. 16 gauge galvanized subpanel.

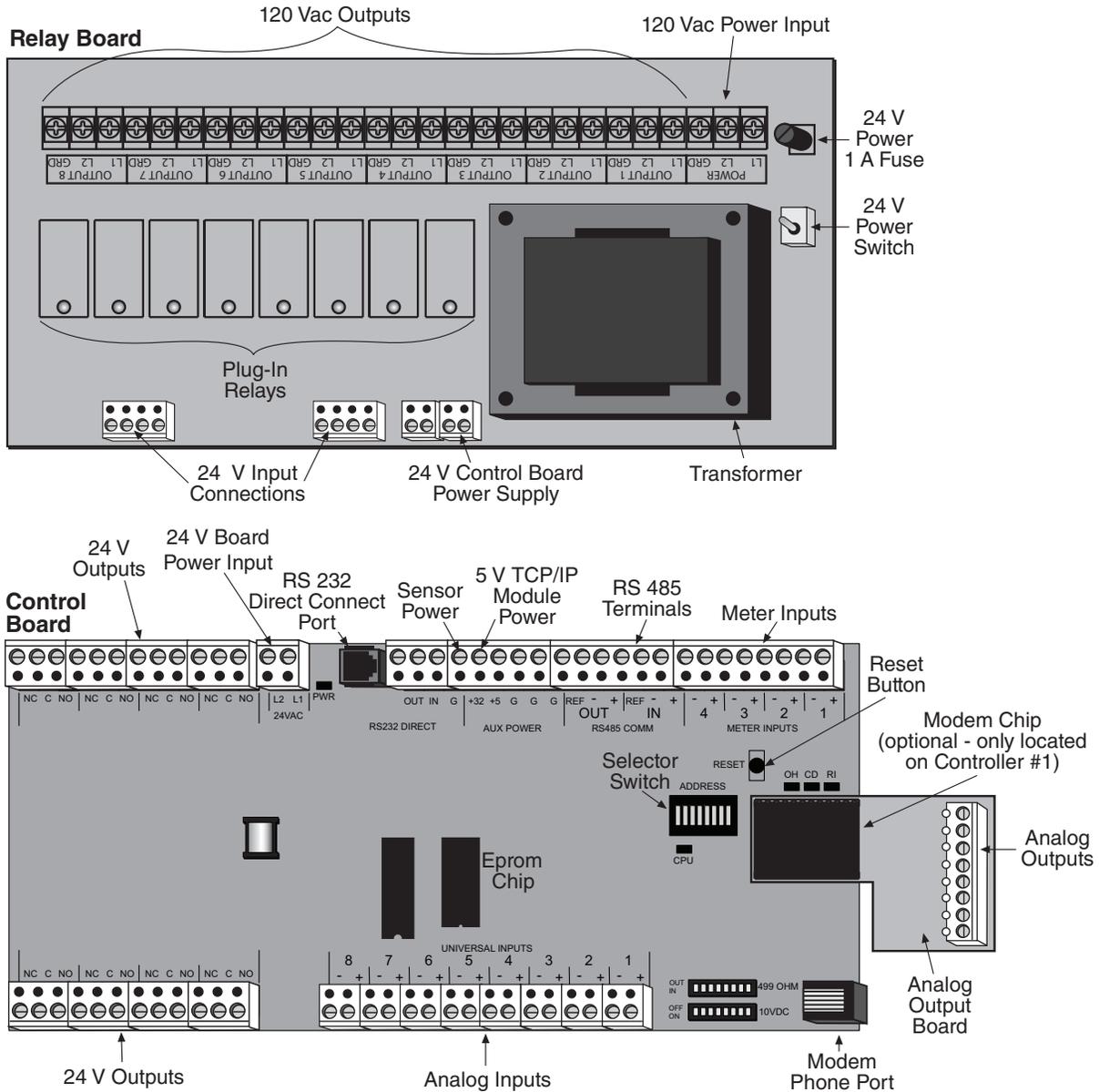
Protection

Rating: NEMA 4/4x/12/13

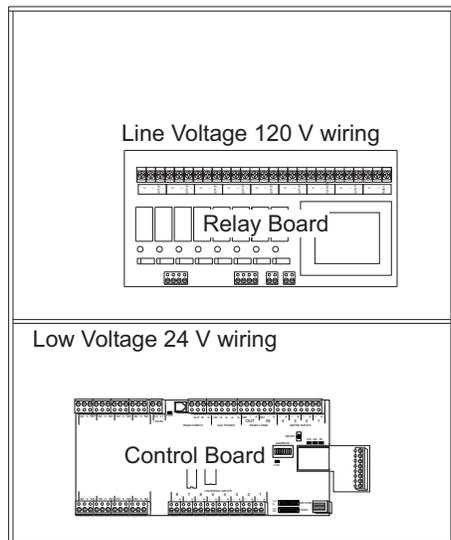
Flammability

Rating: UL-94-5V

FIGURE 2: ROBERTS GORDON® ULTRAVAC™ Controller Specifications



Controller Enclosure



Note:

To ensure robust control signaling:
 Do not run line voltage wiring through bottom section of enclosure that houses the control board.
 Do not run low voltage wiring through top section of enclosure that houses the relay board.

2.3 Variable Frequency Drive (VFD)

2.3.1 Enclosure

Standard Models

Construction: 14 gauge painted steel, mounting panel included, left-hinged door, vented.

Dimensions: 12" w x 14 3/8" h x 8" d

Protection: UL 50 Type 1, NEMA Type 1

NEMA 4 Models

Description: Drive assembly and components fully factory assembled inside NEMA 4 enclosure. Enclosure dimensions and construction vary by model.

Construction: VFD75115N4, VFD20230N4 and VFD20460N4 enclosures are 16 gauge painted steel, left hinged door, non-vented.

VFD75230N4 and VFD75460N4 enclosures are 14 gauge steel, left hinged door, non-vented.

Dimensions: VFD75115N4 20" x 16" x 10"
 VFD75230N4 14" x 12" x 8"
 VFD20230N4 20" x 16" x 10"
 VFD75460N4 16" x 14" x 10"
 VFD20460N4 20" x 16" x 10"

Protection: NEMA 3R/4/12/13

2.3.2 Electrical

Power Output: 230 V, 3 Ø, 0-60 Hz
 (for 115 V and 230 V models)
 460 V, 3 Ø, 0-60 Hz
 (for 460 V models)

Speed Reference

Follower: 0-10 Vdc

UL Standard: Industrial Controls Equipment

Ambient

Operating Temp.: 32°F - 104°F (0°C-40°C)

.75 HP, 230 V Drive (used with EP-203 pump)

(P/N VFD75230 or VFD75230N4)

Power Input: 208/240 V, 1 Ø, 50-60 Hz

Input Voltage Tolerance: +/- 10%

Amps: 6.9/6.0 A

1 HP, 120 V Drive (used with EP-203 pump)

(P/N VFD75115 or VFD75115N4)

Power Input: 120 V, 1 Ø, 50-60 Hz

Input Voltage Tolerance: +/- 10%

Amps: 16.6 A

2 HP, 230 V Drive (used with EP-303 pump)

(P/N VFD20230 or VFD20230N4)

Power Input: 208/240 V, 1 Ø, 50-60 Hz

Input Voltage Tolerance: +/- 10%

Amps: 18.4/16.0 A

1 HP, 460 V Drive (used with EP-203 pump)

(P/N VFD75460 or VFD75460N4)

Power Input: 400/480 V, 3 Ø, 50-60 Hz

Input Voltage Tolerance: +/- 10%

Amps: 3.0/2.5 A

2 HP, 460 V Drive (used with EP-303 pump)

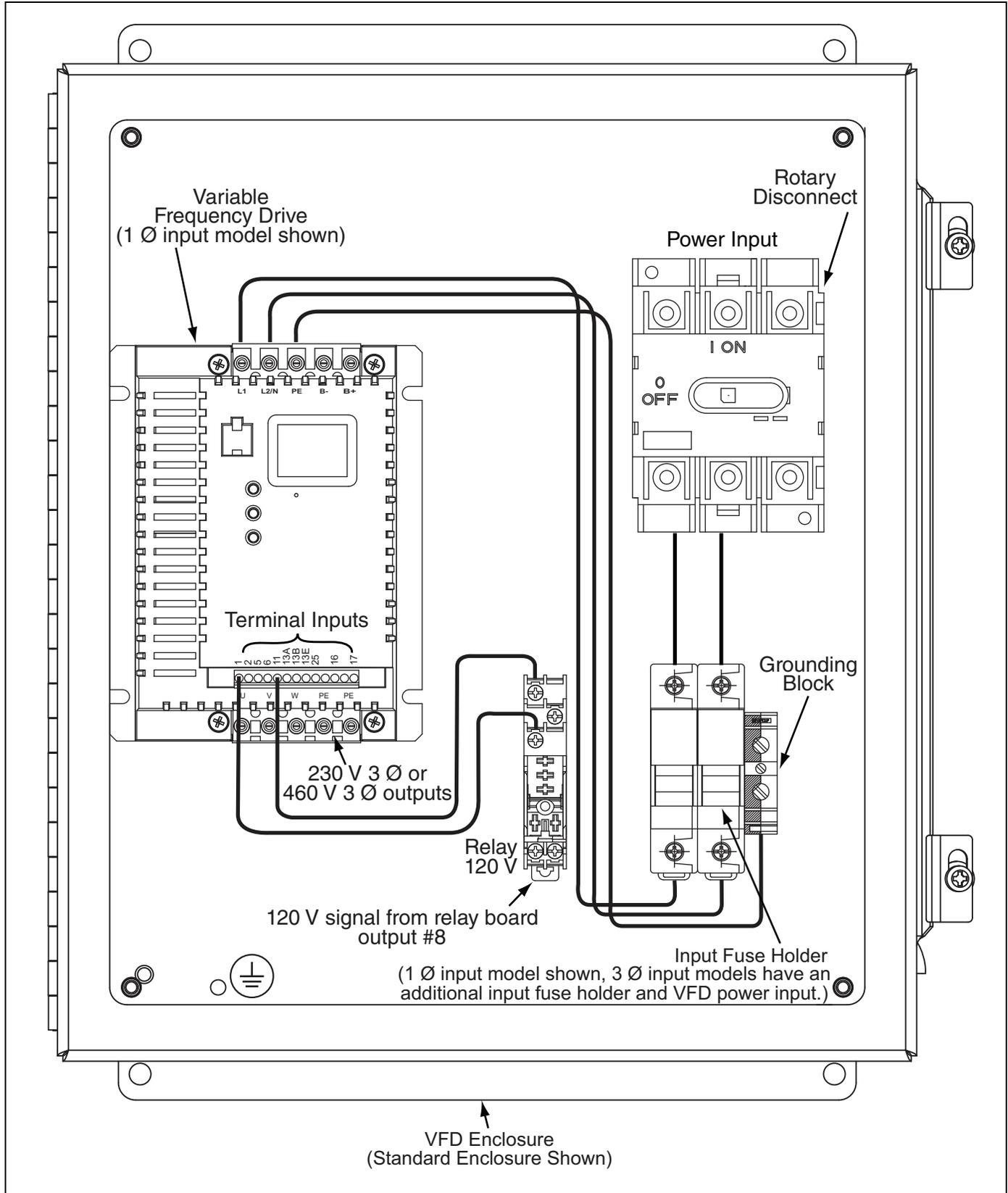
(P/N VFD20460 or VFD20460N4)

Power Input: 400/480 V, 3 Ø, 50-60 Hz

Input Voltage Tolerance: +/- 10%

Amps: 4.8/4.0 A

FIGURE 3: Variable Frequency Drive Components (Factory pre-wiring shown)



SECTION 3: INSTALLATION

| ⚠ WARNING | |
|---|--|
|  | <p style="text-align: center;">Severe Injury Hazard</p> <p>Mount controls with materials with a minimum working load of 75 lbs (33 kg).</p> <p>Failure to follow these instructions can result in death, injury or property damage.</p> |

Installation of the ROBERTS GORDON® ULTRAVAC™ Controller and the associated external electrical wiring must be done by an electrician qualified in the installation of control systems for heating equipment.

3.1 Preparation

Before installing the controller, observe the following:

- 3.1.1** Ensure that you have a copy of the site layout for the project that clearly identifies the separate zones.
- 3.1.2** Familiarize yourself with the Controller and Variable Frequency Drive component names and locations. See Page 8, Figure 2 and Page 10, Figure 3.

3.2 Positioning the ROBERTS GORDON® ULTRAVAC™ Controller and Variable Frequency Drive

3.2.1 Choose a mounting location for the controller. Generally near the pump, a dedicated phone connection (optional) and the variable frequency drive. For serviceability, it is convenient to mount the controller and variable frequency drive at occupant level in the vicinity of the pump.

Do not mount controller or VFD outdoors. VFD must not be installed where subjected to adverse conditions such as: combustible, oily, or hazardous vapors or dust; excessive moisture or dirt; vibration. To avoid damage from possible drips, do not mount controller or VFD directly beneath pump. Models with NEMA 4 rated enclosures will withstand exposure to dust, dirt and water.

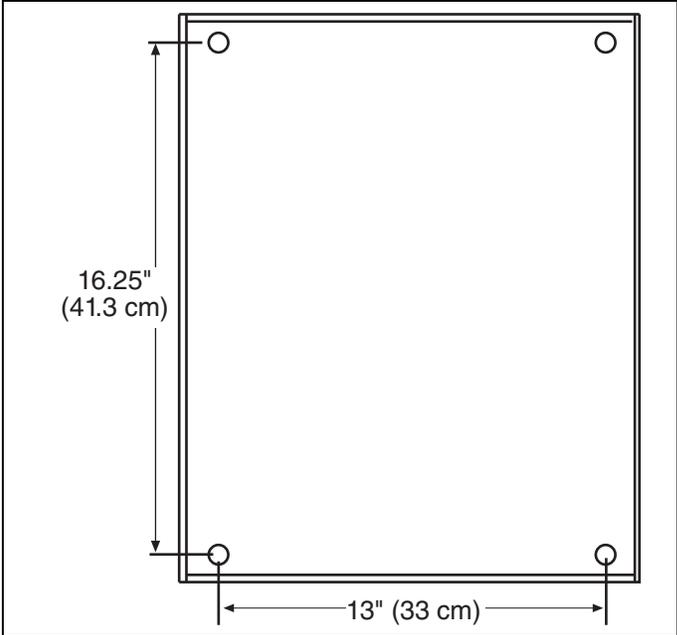
VFD should be mounted in locations where the maximum ambient temperature does not exceed 104°F (40°C). Avoid installing the VFD in mezzanines, direct sunlight, or near external heat

sources because these locations usually have unpredictable temperature rises.

Note that the maximum distance from the controller to any sensor is 300' (120 m). For longer distances, larger gauge wire may be needed (Consult your local distributor). For multiple controllers, maximum length of communication wire from the first controller to the last is 4000' (1219 m).

3.2.2 Position the controller and VFD at occupant level for ease of service. To avoid electrical interferences with communications bus, do not mount VFD directly next to controller. Allow 2' (.6 m) minimum between controller and VFD.

FIGURE 4: Controller Mounting
(Standard enclosure only, NEMA 4 enclosure mounting varies)



3.3 Cable Requirements:

3.3.1 Line Power Supply:

As per individual building specification for class of cable to be used. Use copper conductors only. To size the cable, use the amperages of the burners given on *Page 13, Section 3.4.1*, for each individual zone.

3.3.2 Control Wiring

All control wiring (sensor, VFD control (0 - 10 Vdc), pressure switch and RS-485 communication wiring) may be plenum or non-plenum rated depending on installation requirements, consult the National Electric Code® (NEC). Regardless of the code or its interpretation, the local Fire Marshall makes the final decision, contact the local Fire Marshall if you have questions.

Do not run control (low voltage) wiring together with power (line voltage) wiring in the same conduit. Electrical signal interference or induced current could occur and cause communication problems.

VFD (0-10 V) control wiring and all RS-485 communication wiring must be shielded. Shielded wire provides noise and interference isolation and reduces the possibility of communication problems. **Pressure switch wiring is not required to be shielded.** If electrical interference from machinery or other sources cannot be avoided, shielded wire must be used. All control cable specification diagrams shown will refer to shielded cable.

3.3.3 Indoor Sensor Cable:

Shielded cable (four twisted pairs of stranded 24 AWG min. wire) is required for use with indoor sensors. See *Page 12, Figure 5* for an illustration of the shielded cable specification to be used. See *Page 12, Section 3.3.2* to see if unshielded cable may be used.

Unshielded Cable: AMP #57248, #219538, #219513; Belden # 1585A, #1583A;

General Cable #C6015 or equivalent.

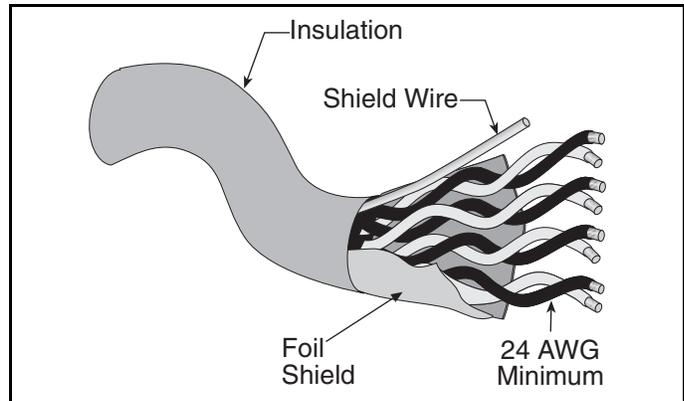
Shielded Cable:

Madison Cable #08CFJ10001, #08CFJ00004;

Belden #9681;

General Cable #2131673, #C1676 or equivalent.

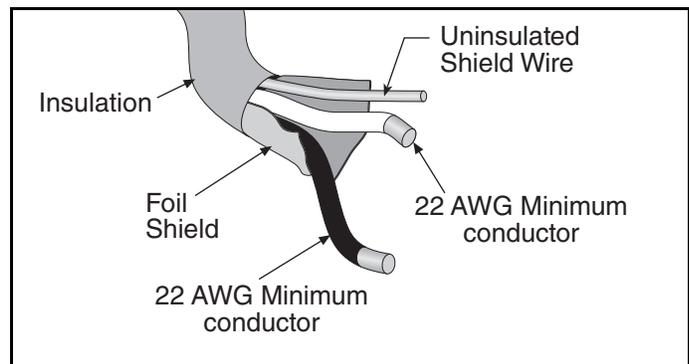
FIGURE 5: Indoor Sensor Cable Detail



3.3.4 Outdoor Air Sensor VFD (0-10 V) signal, Pressure Switch Cable and PC RS-485 converter wiring:

Shielded cable (one twisted pair of 22 AWG min. wire) is required for the outdoor air sensor, VFD signal wiring, pressure switch wiring and RS-485 converter wiring between controller #1 and PC (RS-485 converter wiring to PC is only used if controller is using an RS-485 Converter Communication Package). See *Page 12, Figure 6* for an illustration of the cable specification to be used. Shielded Cable: Belden #8451, #1503A, #8760; General Cable #C2514 or equivalent.

FIGURE 6: Outdoor Sensor, VFD (0-10 V) Signal, RS-485 Communications Cable and Pressure Switch Cable Detail

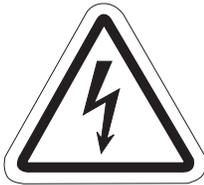


3.3.5 RS-485 Communication Wire Between Controllers:

Shielded cable (one twisted triad or two twisted pairs of 22 AWG min. wire) is required for RS-485 communications between controllers. See *Page 12, Figure 6* for an illustration of the shielded cable specification to be used. Shielded Cable: Belden #1902, #8770 General Cable #C1670 or equivalent.

3.4 Electrical Installation Requirements

⚠ DANGER



Electrical Shock Hazard

Disconnect electrical before servicing.

This appliance must be connected to a properly grounded electrical source.

Replace cover before operating.

Failure to follow these instructions can result in death or electrical shock.

3.4.1 The enclosure must be supplied from a local fused isolator rated for a total amperage not exceeding 25 A.

The method for calculating the current loading is as follows:

CORAYVAC® Burner 0.3 A/burner

Multiply the current for the individual burners above by the number of burners supplied from the enclosure to give the total current required.

The full load amps for the optional outside air blower (P/N 90707500) are: 1.6 A

The total added current load for each individual relay must not exceed 3 A.

The total added current load for all 8 relays must not exceed 25 A.

3.5 Pump Requirements

The pump is powered directly from the Variable Frequency Drive (VFD). The VFD will be energized via an output from the relay board switched through a designated relay.

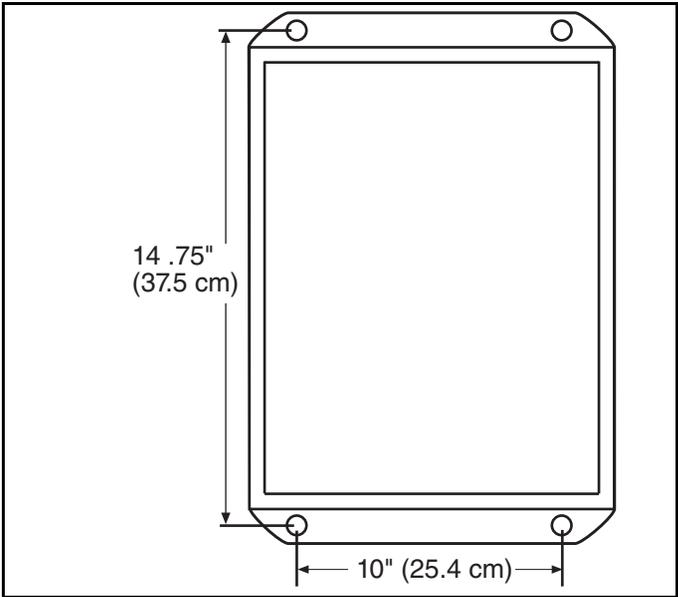
3.6 Variable Frequency Drive Requirements

The VFD must be powered separately from the control enclosure. The 230 V drive power supply must be 230 V, 50-60 Hz, 1 Ø. The 120V drive power supply must be 120 V, 50-60 Hz, 1 Ø. The 460 drive power supply must be 460 V, 50-60 Hz, 3 Ø. See Page 9, Section 2.3 for additional details. The VFD on/off switching is done by an output on the relay board.

The 0-10 V signal from the ULTRAVAC™ controller enclosure wired into VFD input relays 5 and 2 (see Page 16, Figure 11 through Page 18, Figure 12) will dictate the speed of the pump. The VFD output supply to the pump is 230 V 3 Ø 0-60 Hz for 115 V and 230 V models and is 460 V, 3 Ø, 0-60 Hz for 460 V models. The frequency of the output supply signal to the pump will be varied based on the 0-10 V signal from the control enclosure. See Page 11, Section 3.2 for additional installation requirements.

FIGURE 7: Variable Frequency Drive Mounting

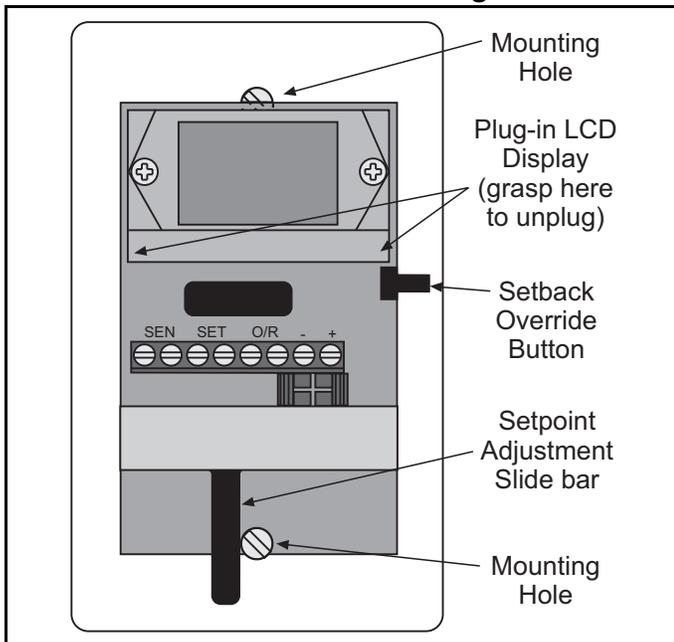
(Standard enclosures only, NEMA 4 enclosure mounting varies by model)



3.7 Indoor Sensor Placement

The sensor measures the air temperature in the building. It is important that the sensor is located in an area within the heated zone at occupant level. For the most accurate results, sensors should be mounted on an inside wall, away from any air vents or other sources of heat and cold. In order to avoid short system cycles and inaccurate temperature readings, do not mount sensors under the first section of radiant tube (first 10' (3 m) section of tube after the burner), in direct sunlight or in the path of other sources of radiant heat. The sensors are suitable for direct surface mounting or 4" x 2 1/8" junction box mounting.

FIGURE 8: Indoor Sensor Mounting



3.7.1 Indoor Sensor Mounting

Remove the cover of the sensor by the two 1/16" allen screws, located in the lower corners of the cover. To gain access to the top mounting hole, remove the plug-in LCD display. To remove the LCD display, grasp the green plug-in board at the lower corners and gently pull the board away from the sensor back plate. See Page 14, Figure 8. After removing the plug-in LCD display from its socket, secure the sensor to the wall or junction box using the screws provided. Replace the plug-in LCD display and secure the cover with the two 1/16" allen screws.

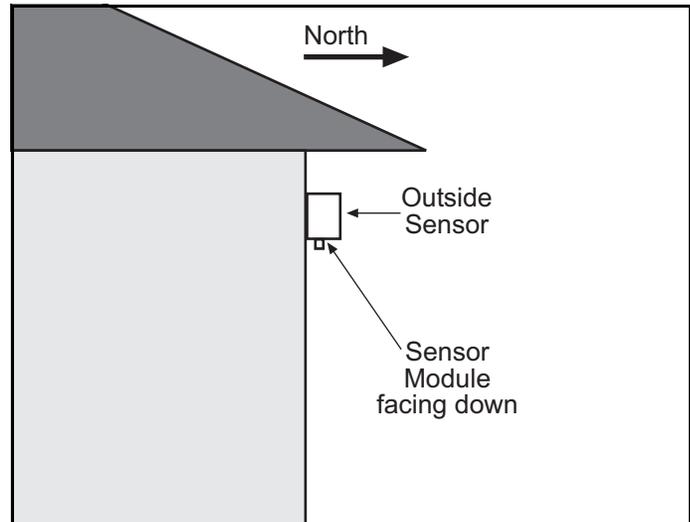
Wiring from 32 V terminals on the controller to sensor power terminals "+" and "-" is polarity sensitive. Reversing polarity may cause sensor damage. Refer to Page 16, Figure 11 and Page 18,

Figure 12 for wiring details.

3.8 Outdoor Sensor Placement

The outdoor sensor measures air temperature outside the building. It is important that the sensor is located on the outside of the building on the north facing wall. Failure to mount the sensor on the north facing wall will result in artificially high temperature readings. If possible, locate the sensor high under an eave to prevent incorrect readings from direct sunlight and damage due to the elements.

FIGURE 9: Outdoor Sensor Placement



Mount the outside sensor with the sensor module facing down to prevent accumulation of dirt or water.

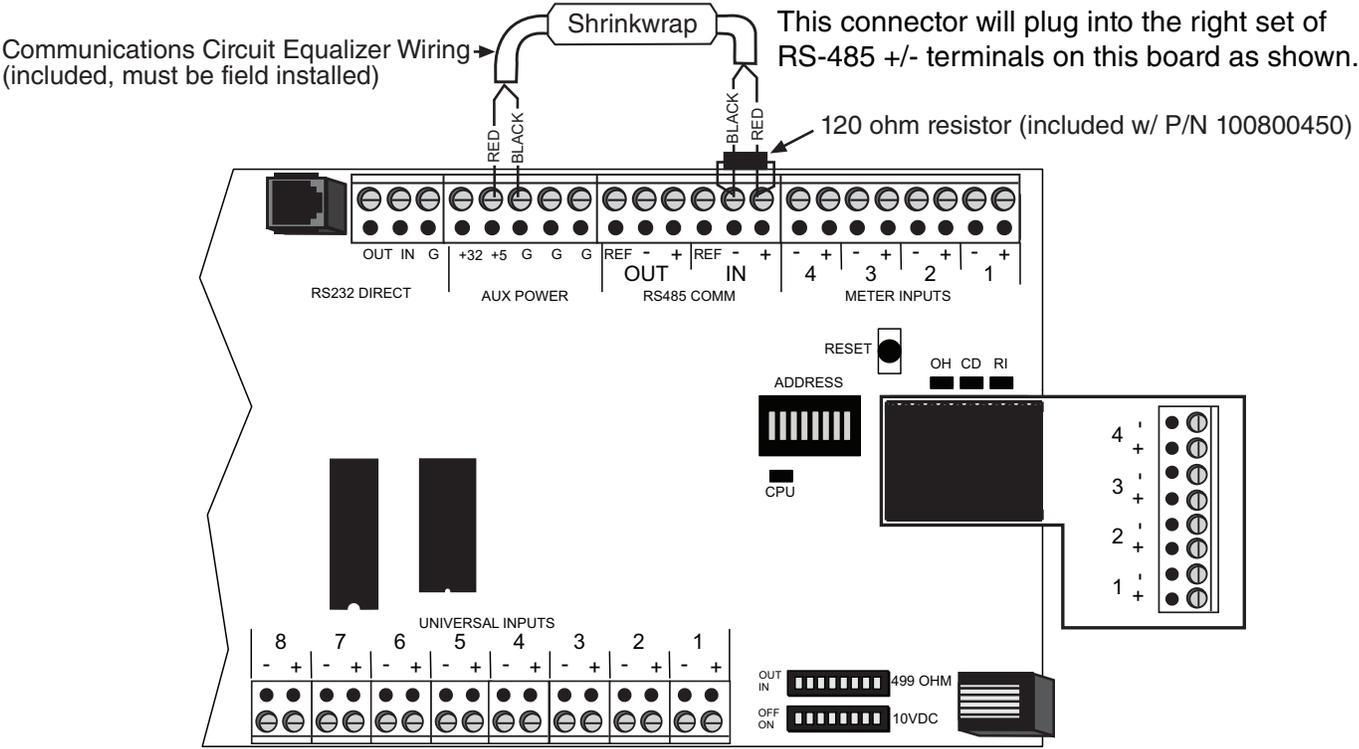
3.9 Outside Air Supply

If an outside air blower is to be used, See Page 16, Figure 11 for external wiring diagrams. See Page 13, Section 3.4.1 for current load.

SECTION 4: TYPICAL EXTERNAL DIAGRAMS

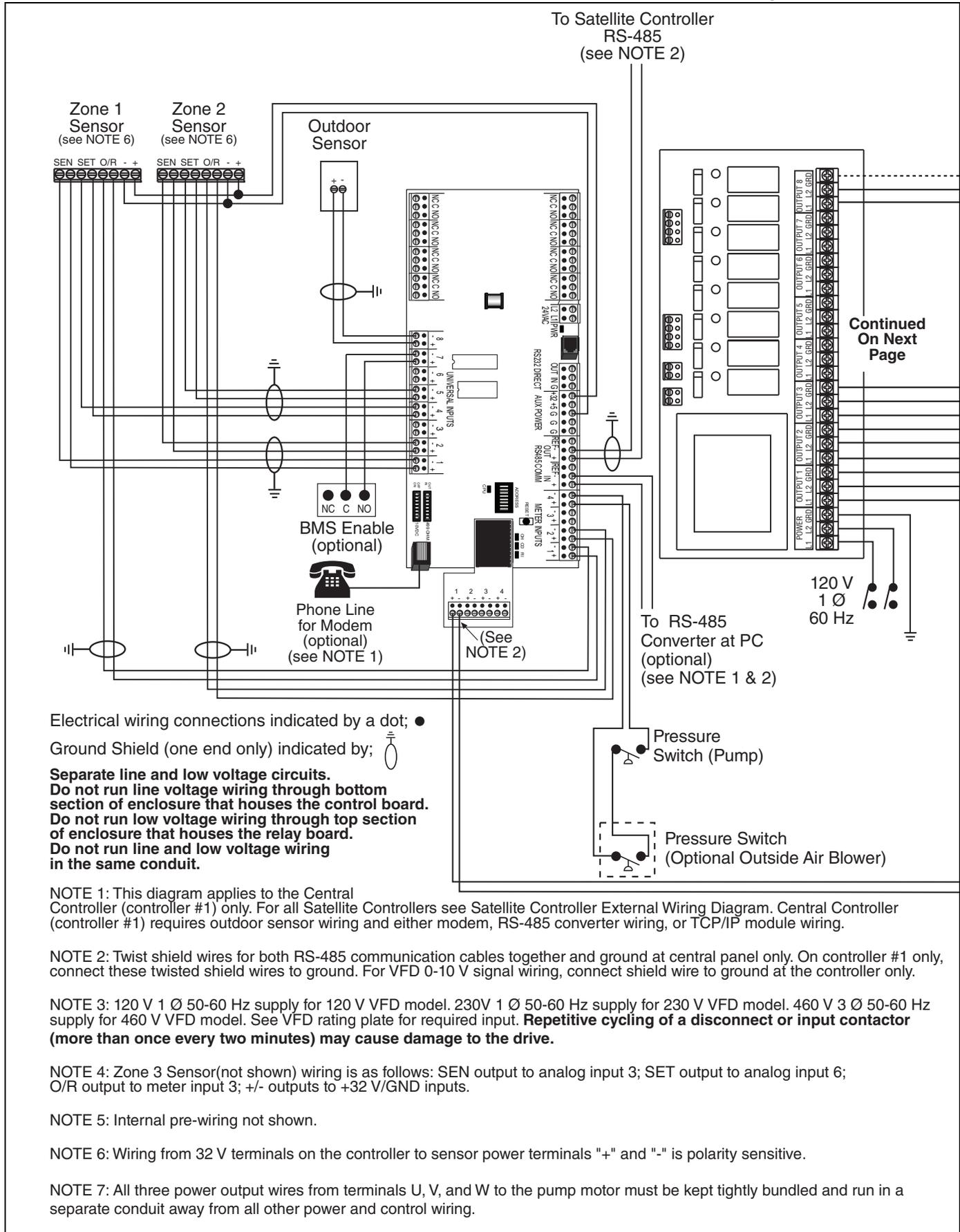
FIGURE 10: Central Controller Communication Equalization Wiring

All ULTRAVAC™ Central Controllers are shipped with a communication equalization cable (P/N 10080450). The cable is supplied to equalize and balance the circuitry of the communications on the controller network that may be experiencing noise or transient voltage levels. Connect the communication equalization cable as shown below to the first or the last controller on the data bus.

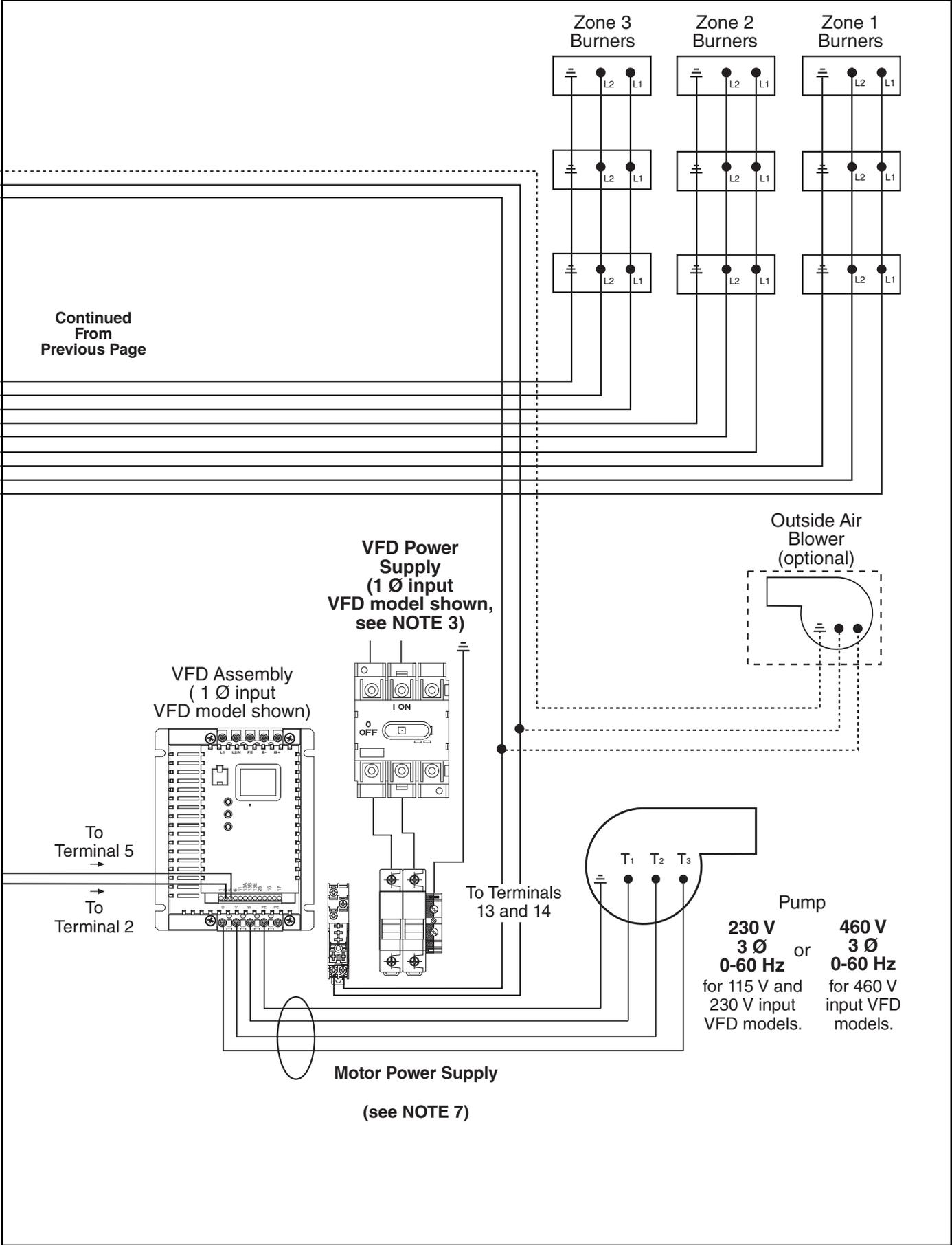


| Description | Part Number |
|--------------------------|-------------|
| Comms Equalization Cable | 10080450 |

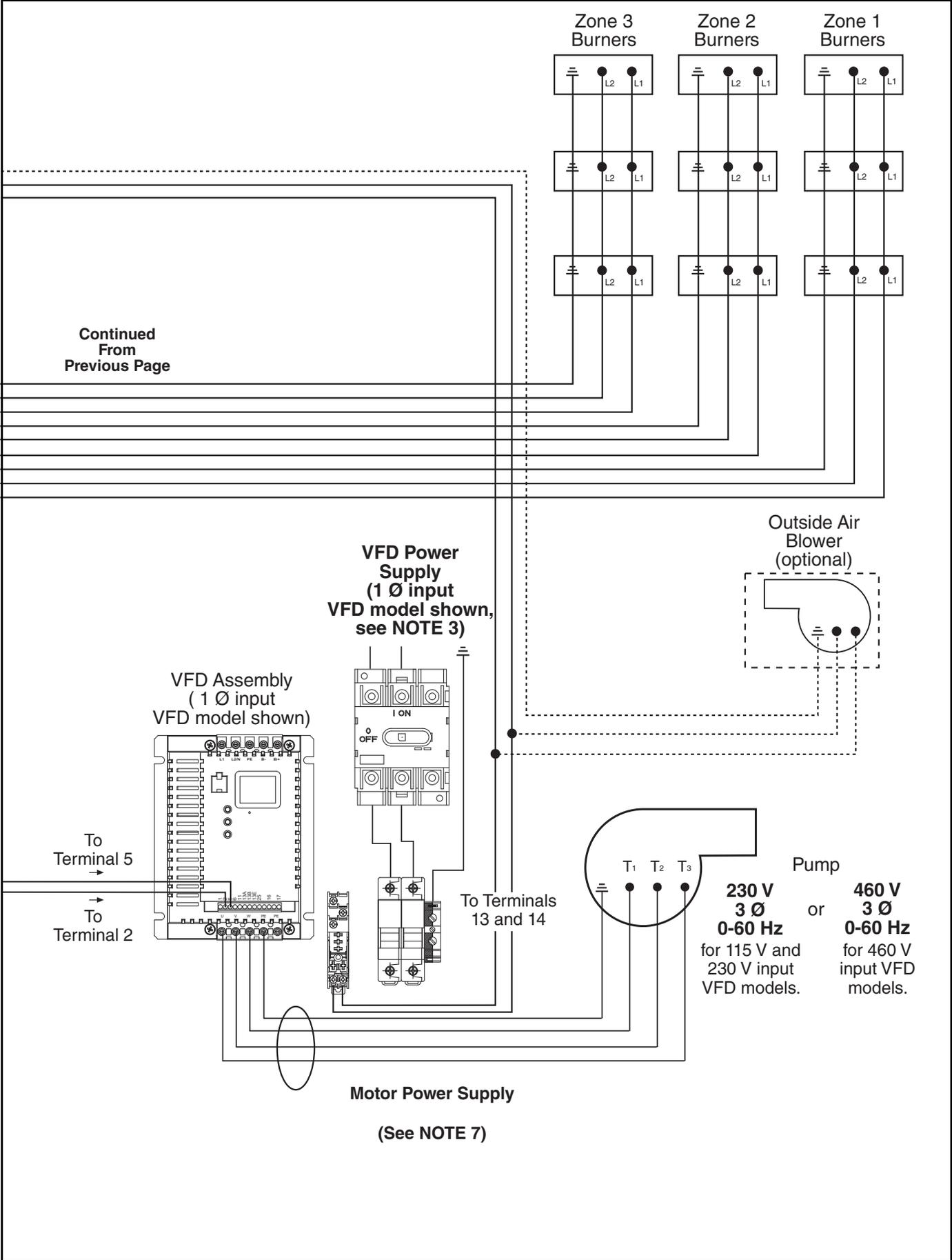
FIGURE 11: ROBERTS GORDON® ULTRAVAC™ Central Controller External Wiring



ROBERTS GORDON® ULTRAVAC™ Central Controller External Wiring (continued)



ROBERTS GORDON® ULTRAVAC™ Satellite Controller External Wiring (continued)



SECTION 5: COMMUNICATIONS

One ROBERTS GORDON® ULTRAVAC™ Controller per building (called the "central controller) must have equipment for remote communications to a PC. This equipment consists of either a modem chip, an RS-485 converter, or a TCP/IP communications module.

For remote **on-site and off-site** control and system status viewing the central controller (controller #1) is fitted with a **modem chip**. See Page 20, Section 5.1.

If only remote **on-site** control and system status viewing, two controller communications interface devices are available: an **RS-485 converter** or a **TCP/IP communication module**.

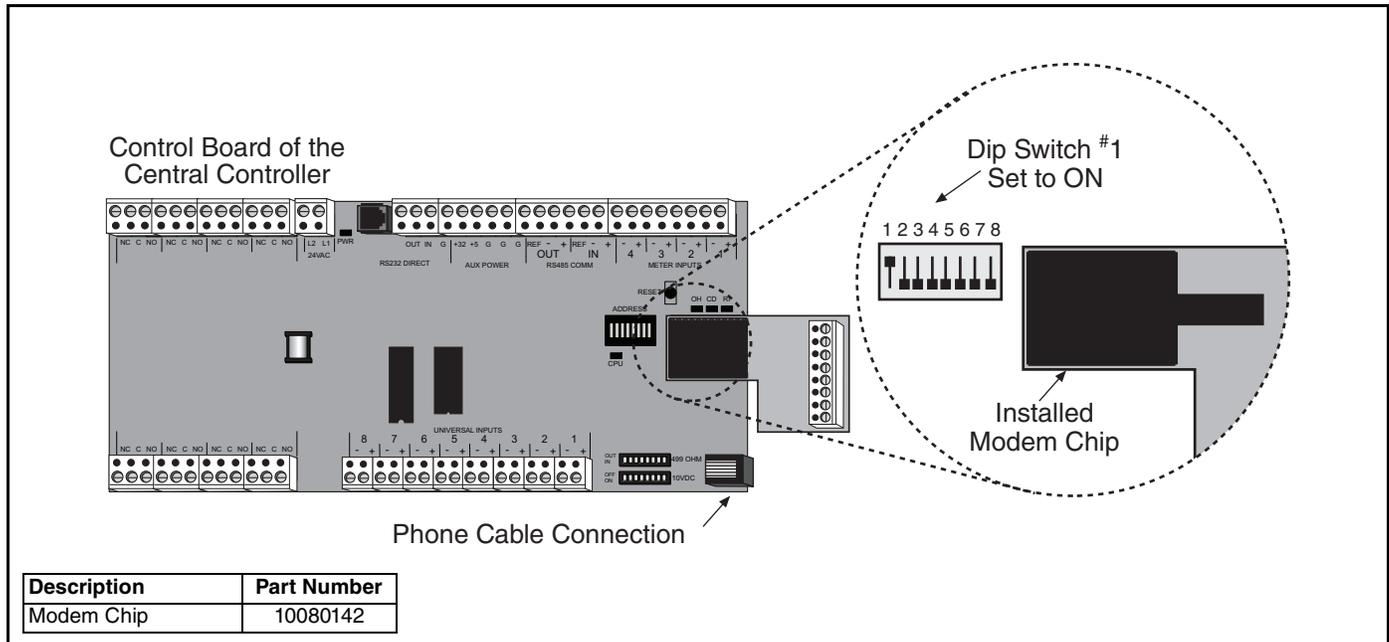
An RS-485 converter is installed at a single PC, this PC can interface with any controller on the network of ULTRAVAC™ controllers. The RS-485 converter at the PC is wired directly to controller #1 using

shielded twisted pair communication wiring. See Page 21, Figure 14.

To interface with ULTRAVAC™ controllers through a Local Area Network (LAN), a TCP/IP Communication module is installed at controller #1. Controller #1 is wired to the LAN by an Ethernet cable. See Page 22, Section 5.3. Any computer on the LAN that has ULTRAVAC™ software installed can communicate with the controllers. Appropriate precautions must be taken to protect the Ethernet wiring from any possible electrical interference (noise) caused by surrounding machinery or equipment.

If multiple ULTRAVAC™ controllers are being used, the additional controllers communicate to controller #1 through communication wiring arranged in-series from one controller to the next. See Page 25, Section 5.5.

FIGURE 13: Modem Location



5.1 Dedicated Phone Line for Central Controller Modem

The Central Controller is fitted with a modem chip. To use the modem, the controller must have a phone line for modem communications. Install a phone line near the location of the Central Controller. The phone cable is plugged into the phone connection in the corner of the control board. See Page 20, Figure 13. If the modem option is not used for everyday communication to the controller(s), it can still be plugged into a phone line for troubleshooting or programming assistance. Contact your local Roberts-Gordon independent distributor for details.

If multiple ULTRAVAC™ controllers are being used, the additional controllers communicate to controller #1 through RS-485 communication wiring arranged in-series from one controller to the next. See Page 25, Section 5.5. This allows multiple controllers to be controlled from a PC through a single communication package at the central controller.

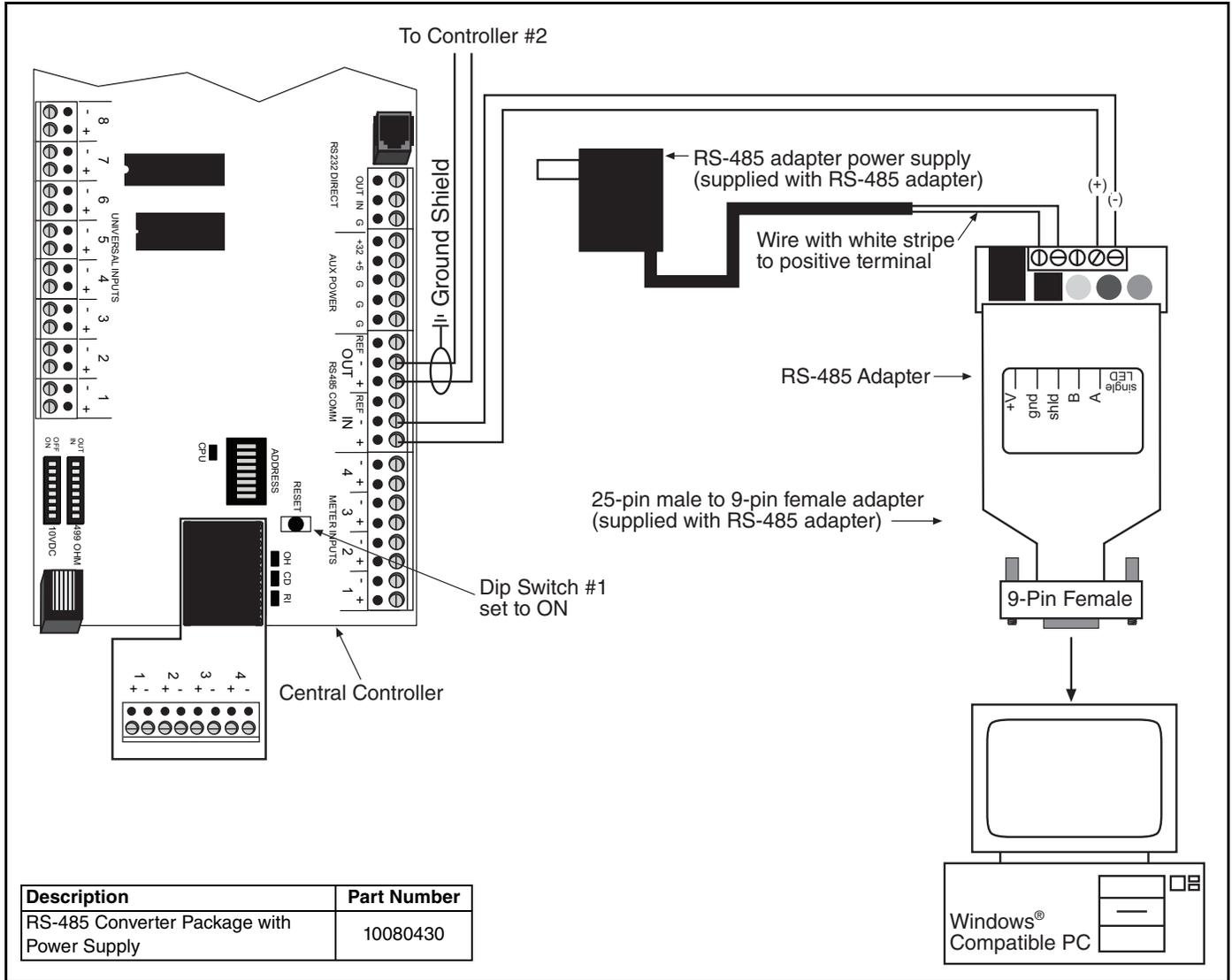
5.2 RS-485 Converter for Central Controller

For remote on-site viewing of system status and settings of any controller, use the RS-485 converter to connect a single PC (9 pin serial port) to the RS-485 terminals on the Central Controller. This will allow communication between one PC and any of the ULTRAVAC™ controllers on the network. For RS-485 converter wiring details see Page 21, Figure 14 and see Page 25, Section 5.5

For communication cable requirements see Page 12, Section 3.3.5.

If multiple ULTRAVAC™ controllers are being used, the additional controllers communicate to controller #1 through RS-485 communication wiring arranged in-series from one controller to the next. See Page 25, Section 5.5. This allows multiple controllers to be controlled from a PC through a single communication package at the central controller.

FIGURE 14: RS-485 PC Connection



5.3 TCP/IP Communication Module

For remote on-site viewing of system status and settings of any controller, use the TCP/IP communication module to connect the controllers to a Local Area Network (LAN) via Ethernet cable. Any computer on the LAN that has ULTRAVAC™ software installed can be used to communicate with the controllers.

The module must be mounted inside the ULTRAVAC™ central controller (controller #1) enclosure next to the control board. The power (5V) for the module will come from the ULTRAVAC™ control board. The module will communicate to the controller via regular phone wire from the RJ11 jack on the module to the RS-232 direct connect port on the control board. The module will relay the data

from the controller to computers on the LAN via Ethernet cable plugged into the RJ45 jack on the module. A setup procedure must be performed on the module upon installation to create its IP address on the LAN. The setup instructions can be found in the ROBERTS GORDON® Software Manual.

For TCP/IP communication module wiring details, see Page 23, Figure 16.

If multiple ULTRAVAC™ controllers are being used, the additional controllers communicate to controller #1 through RS-485 communication wiring arranged in-series from one controller to the next. See Page 25, Section 5.5. This allows multiple controllers to be controlled from a PC through a single communication package at the central controller.

FIGURE 15: TCP/IP Communication Module Mounting

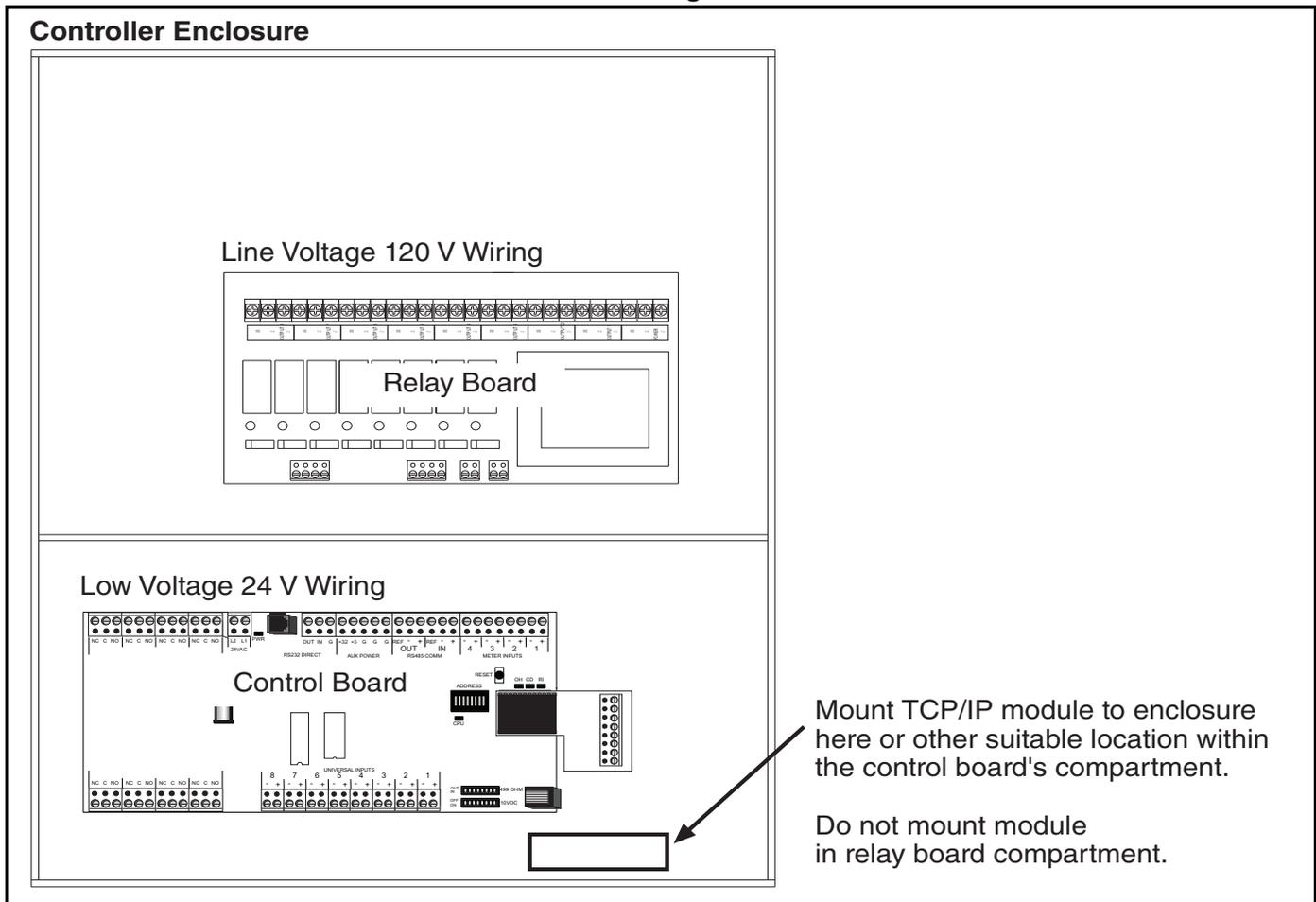
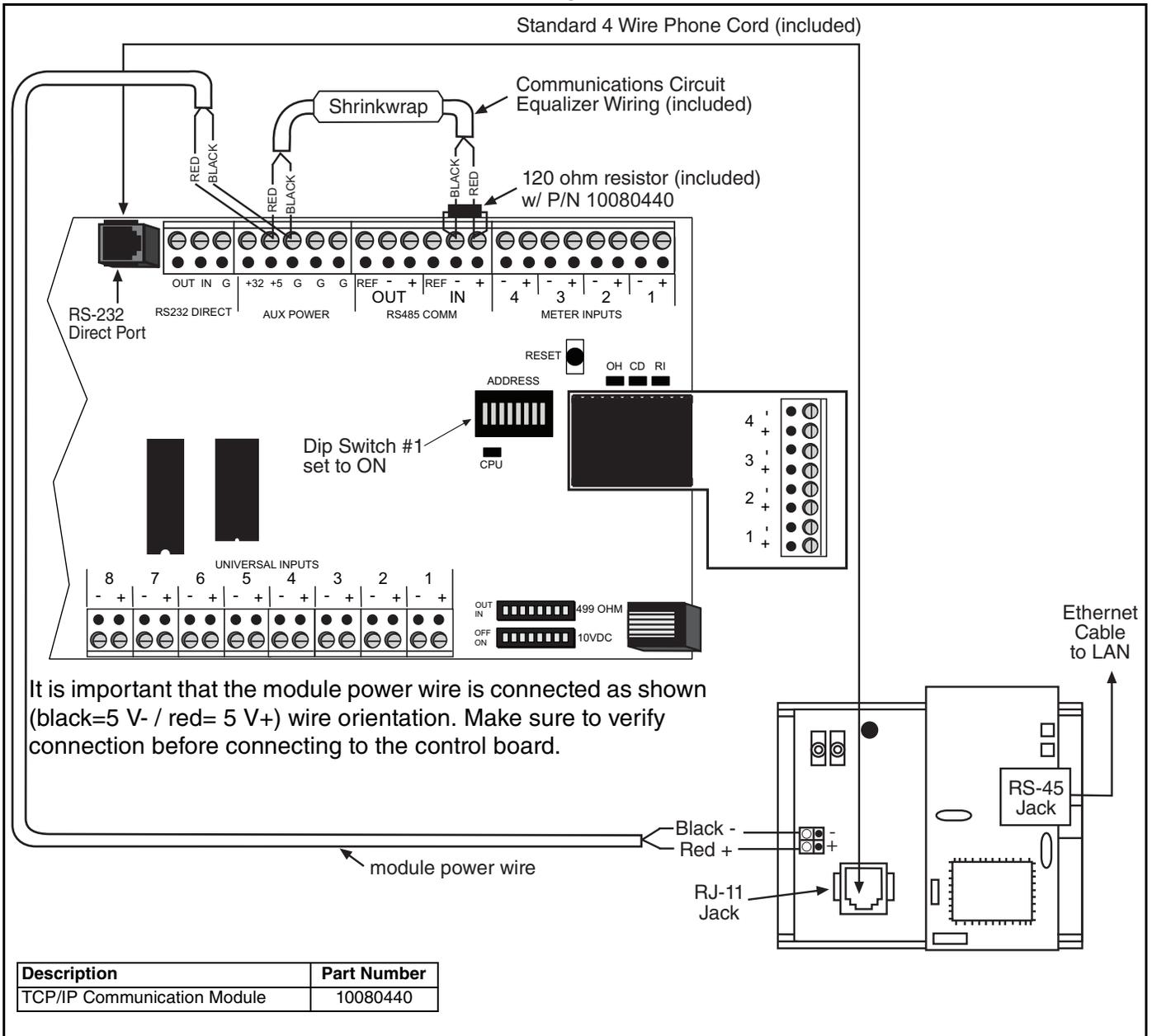


FIGURE 16: TCP/IP Communication Module Wiring



5.4 Direct Connect

For local viewing of system status and settings of any controller, a portable PC can be connected. Using the 9 pin adapter provided, (See Page 24, Figure 17), you may wire from your computer serial port to the RS-232 direct connect port on the control board via standard 4-wire phone cable. For identification of the RS-232 direct connect port, see Page 8, Figure 2.

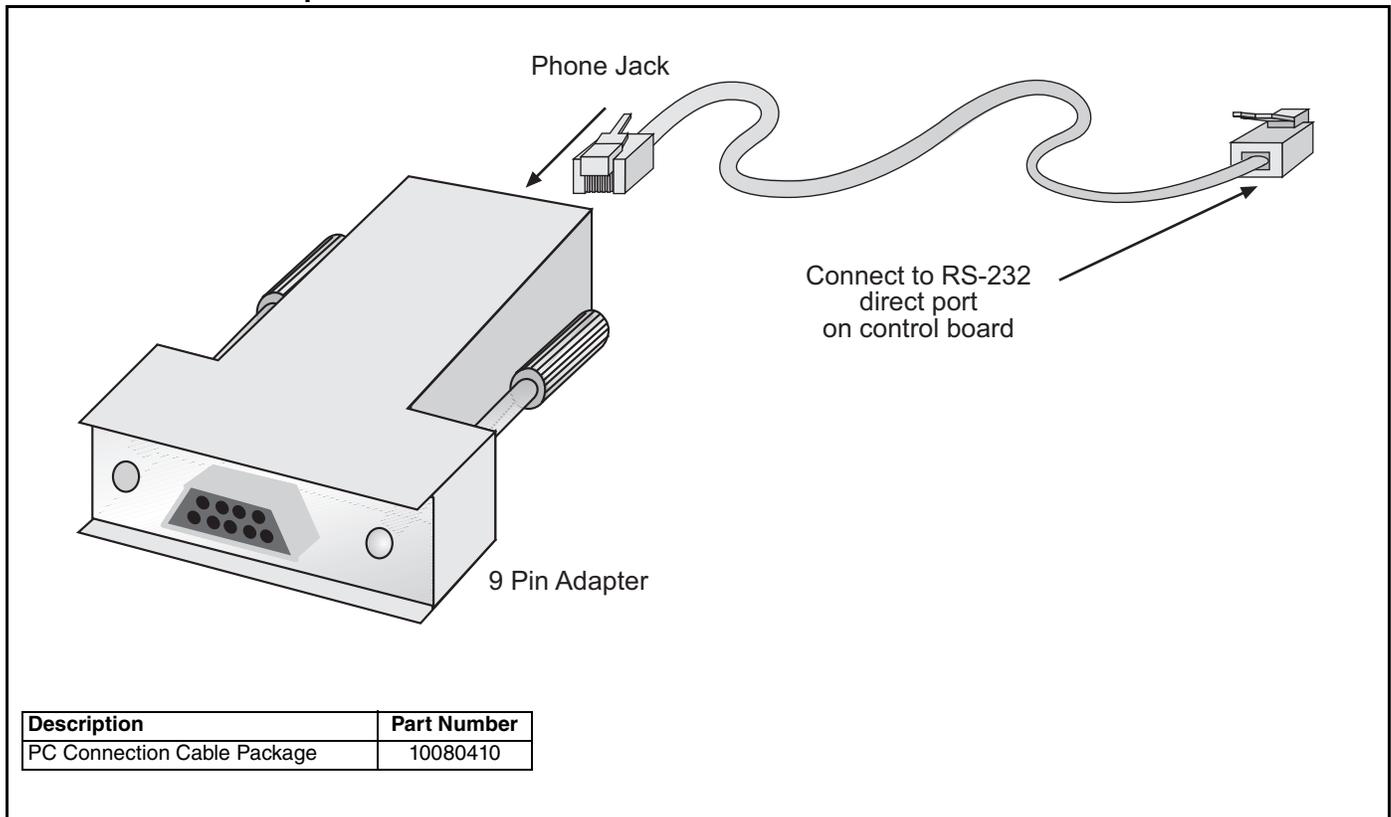
This can be useful when a PC is in close proximity to any ROBERTS GORDON® ULTRAVAC™ Controller or while troubleshooting at the controller using a laptop PC. This type of connector should not be used if the phone wire is more than 50' (15m) in length.

Plug one end of the phone cable into the RS-232 direct port, plug the other end into the adapter shown in on Page 24, Figure 17. Plug the adapter into a 9-pin serial port on your computer.

If a PC does not have a serial port, but does have a USB port, purchase of a USB to Serial Converter is required.

A USB to 9-pin Serial Cable will allow connection between the RS-232 device (ULTRAVAC™ Control Board) and the USB port on the PC. The USB to serial RS232 DB9 Cable Adapter will be used in conjunction with the PC Connection Cable Package (P/N 10080410). USB to Serial RS232 DB9 Cable Adapters can be purchased at a local computer store or on the internet for \$20.00 or less. The converter should come with drivers and should draw power directly from USB, requiring no additional power adapter.

FIGURE 17: 9 Pin Adapter for PC



5.5 Communications Between Multiple ROBERTS GORDON® ULTRAVAC™ Controllers

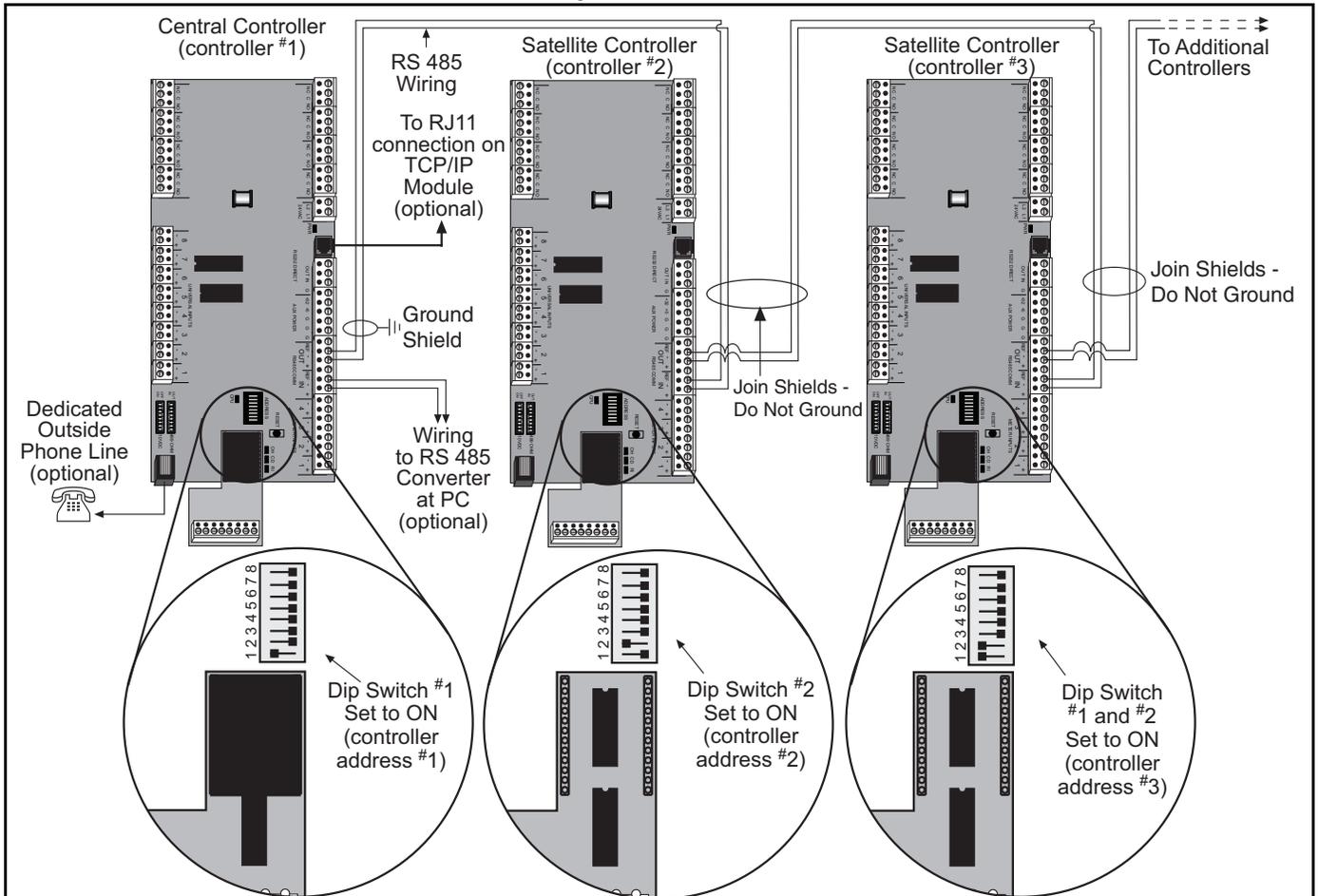
If more than one ROBERTS GORDON® ULTRAVAC™ Controller is installed in a building, the controllers' RS-485 communications must be wired in series. See Page 25, Figure 18. Connect the RS-485 terminal on controller #1 to the RS-485 terminal on controller #2 and so on in a daisy chain fashion. For communication cable requirements, See Page 12, Section 3.3.5

From a PC, by dialing into the modem on controller #1 or by connecting to controller #1 via RS-485 converter or TCP/IP communication module, the

system status and settings can be viewed for any of the controllers on the network.

The control board identification dip switch must be set on each ROBERTS GORDON® ULTRAVAC™ Controller. See Page 25, Figure 18 for dip switch settings. Contact Roberts-Gordon or your ROBERTS GORDON® independent distributor, if more than 20 controllers are connected.

FIGURE 18: Communications Between Multiple Controllers



| Controller Number | Dip Switch Order (1,2,3,4,5,6,7,8) Values (1=ON, 0=OFF) |
|------------------------|---|
| 1 (Central Controller) | 10000000 |
| 2 | 01000000 |
| 3 | 11000000 |
| 4 | 00100000 |
| 5 | 10100000 |
| 6 | 01100000 |
| 7 | 11100000 |
| 8 | 00010000 |
| 9 | 10010000 |
| 10 | 01010000 |

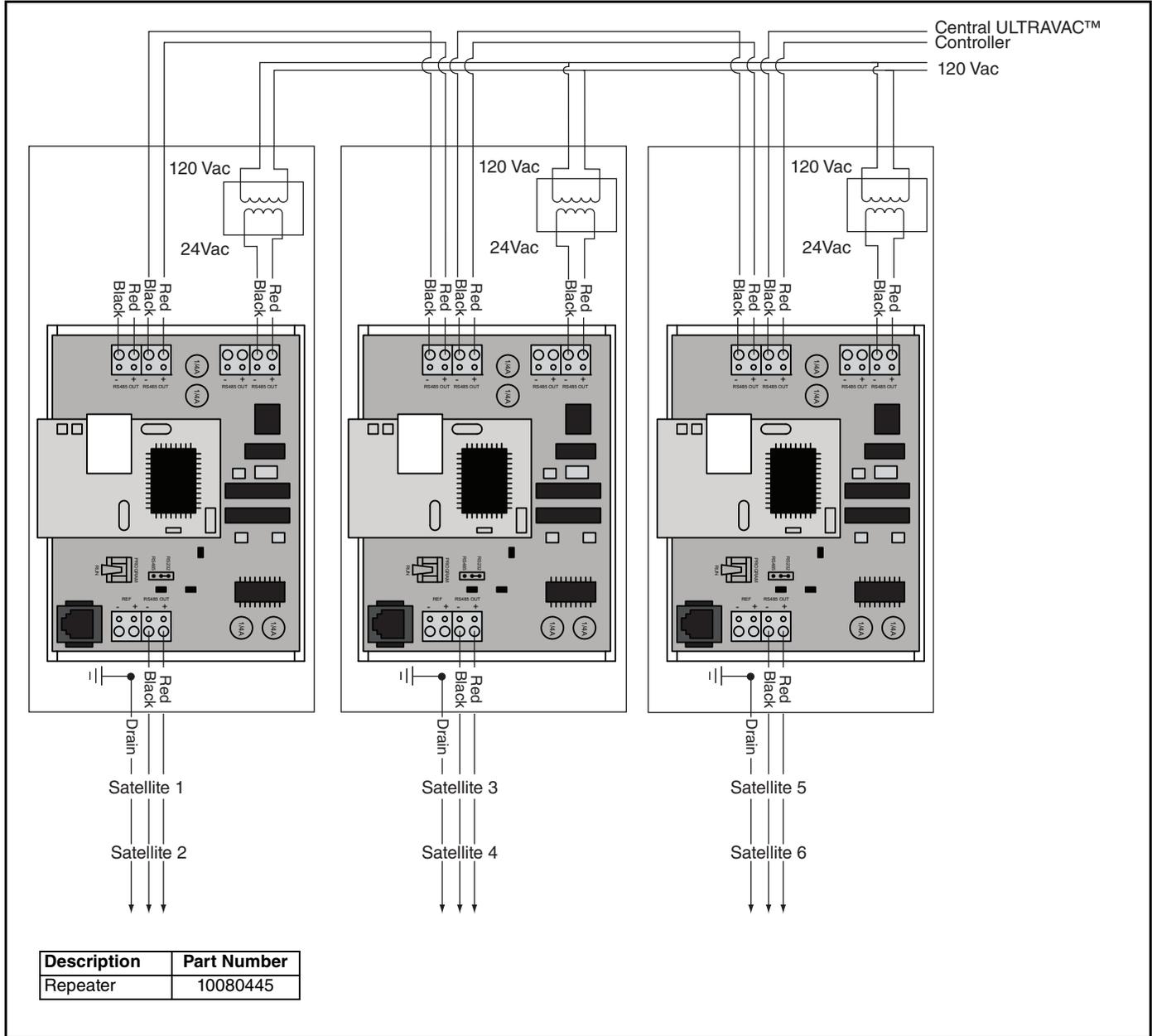
| Controller Number | Dip Switch Order (1,2,3,4,5,6,7,8) Values (1=ON, 0=OFF) |
|-------------------|---|
| 11 | 11010000 |
| 12 | 00110000 |
| 13 | 10110000 |
| 14 | 01110000 |
| 15 | 11110000 |
| 16 | 00001000 |
| 17 | 10001000 |
| 18 | 01001000 |
| 19 | 11001000 |
| 20 | 00101000 |

5.5.1 Repeater

If the RS-485 communications wire length is above 4000', a repeater must be used to extend the signal. The repeater can also be used to create parallel branches of ROBERTS GORDON® ULTRAVAC™ controller communications bus wiring. Each repeater is sold in a 12" x 12" NEMA 1 enclosure with a 120/24 Vac transformer.

There is no limit on the quantities of repeaters used in a system.

FIGURE 19: Repeater Wiring

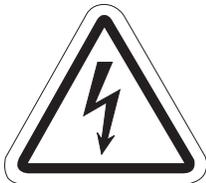


SECTION 6: VARIABLE FREQUENCY DRIVE PROGRAMMING

6.1 VFD Parameter Settings For Use With ROBERTS GORDON® ULTRAVAC™

The VFD parameters come with factory default settings. The following parameter settings must be changed for ROBERTS GORDON® ULTRAVAC™. Settings can only be altered when the pump motor is stopped.

Verify that there is power to the VFD (LCD display will be on) and power to the 24 V power switch on the relay board of the ROBERTS GORDON® ULTRAVAC™ controller is off.

| |
|--|
| ⚠ DANGER |
|  |
| Electrical Shock Hazard |
| Enclosure contains live electrical components. |
| Programming must be done by a trained technician only. |
| Replace cover before operating. |
| Failure to follow these instructions can result in death or electrical shock. |

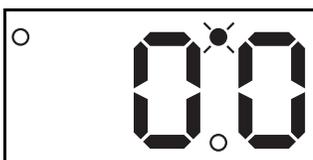
To override the rotary disconnect switch inside the VFD enclosure, turn the square rod with a wrench to the ON position. In order to be able to close the cover of the disconnect, the rods need to be turned back to the OFF position.

6.1.1

To enter the PROGRAM mode and access the parameters, press the Mode button. This will activate the PASSWORD prompt (if the password has not been disabled).

Display reads "00"

Upper right decimal point blinks



6.1.2

Use the arrow buttons to scroll to the password value (the factory set password is 225)

Press Mode to enter password

Once the correct password value is entered, the display will read "P01", which indicates that the PROGRAM mode has been accessed at the beginning of the parameter menu (P01 is the first parameter).



NOTE: If the display flashes "Er", the password was incorrect, and the process to enter the password must be repeated.

6.1.3 Use the arrow buttons to scroll to the desired parameter number. For new parameter settings See *Page 28, Section 6.2*.

6.1.4 Once the desired parameter number is found:

Press Mode to display present parameter setting (example setting is 20.0).

Upper right decimal point blinks.



Use arrow buttons to change setting

Press Mode to store new setting and exit the program mode.

6.1.5 To change another parameter, press the Mode key again to re-enter the PROGRAM mode (the parameter menu will be accessed at the parameter that was last viewed or changed before exiting).

If the Mode key is pressed within two minutes of exiting the PROGRAM mode, the password is not required to access the parameters. After two minutes,

the password must be entered in order to access the parameters again.

6.2 Altering VFD Parameters

Using the procedure described in *Section 6.1.1* through *Section 6.1.5*, alter the following parameters:

| Parameter Number | Parameter Name | Factory Default | New Setting |
|-------------------------|-----------------------|------------------------|--------------------|
| P16 | Units Ending | 02 | 01 |
| P44 | Password | 225 | Any # 000-999 |
| P03 | Start Method | 01 | 05 |

SECTION 7: COMMISSIONING THE CORAYVAC® SYSTEM

NOTE: The ROBERTS GORDON® ULTRAVAC™ software must be installed on the PC, the communication connection must be made to the controller and all wiring of the ROBERTS GORDON® ULTRAVAC™ control boards, relay boards, burners, pumps and VFD must be completed before starting the commissioning procedure.

7.1 Setting The CORAYVAC® End Burner Vacuum

It is important to understand that the frequency that the VFD runs the motor at, determines the speed of the impeller in the pump. Variation of the impeller speed will increase or decrease vacuum in the system. The following procedure will help you set minimum and maximum VFD frequency settings to achieve proper vacuum in the system.

Step 7.1.1 At the controller, turn on the 24 V power switch on the relay board. At the PC, "connect" to the controller (see the ROBERTS GORDON® ULTRAVAC™ Software Installation and Operation Manual, P/N 10081600NA for details) and then open the **manual override screen(Alt + M)**. On the screen, click the "ON" button for the vacuum pump. Wait 30 seconds then click the ON button for zones 1-3.

Step 7.1.2 The pump should be running and the burners should light within 60 seconds. At the VFD, verify that the number displayed on the LCD screen is "60.0" If it is lower than 60.0, hit the "up" arrow button on the VFD until the number reads 60.0 Let the burners fire for approximately 20-30 minutes to warm up the system. Using a manometer, check the end vent vacuum in each zone (each branch of burners). See *Page 30, Figure 20*.

If the lowest end vent vacuum reading is above 3.0" wc, reduce the vacuum pump speed. Generally, the lowest end vent vacuum reading is on the longest branch of the system. Use the down arrow button on the VFD to reduce the frequency of the output signal to the pump, thus reducing the pump speed and lowering the end vent vacuum reading. Continue to reduce the frequency until the end vent vacuum reading is between 2.5" - 3.0" wc. Make note of this frequency setting below. The frequency is found on the VFD's LCD screen.

2.5" wc - 3.0" wc VFD Frequency Setting

Record Frequency Setting Here:

| |
|--|
| |
|--|

To avoid damage to the pump motor, do not adjust the frequency above 60.0 Hz. Verify that the end vent vacuum readings in the remaining branches are

proper. If necessary, adjust the proper damper coupling to achieve an end vent vacuum of 2.5" - 3.0" wc See *Page 30, Figure 20*. Damper couplings should be found near the end of the radiant portion of the pipe in each branch or where a branch connects to other branches at a cross or tee. See *Page 31, Figure 21*.

FIGURE 20: End Vent Vacuum

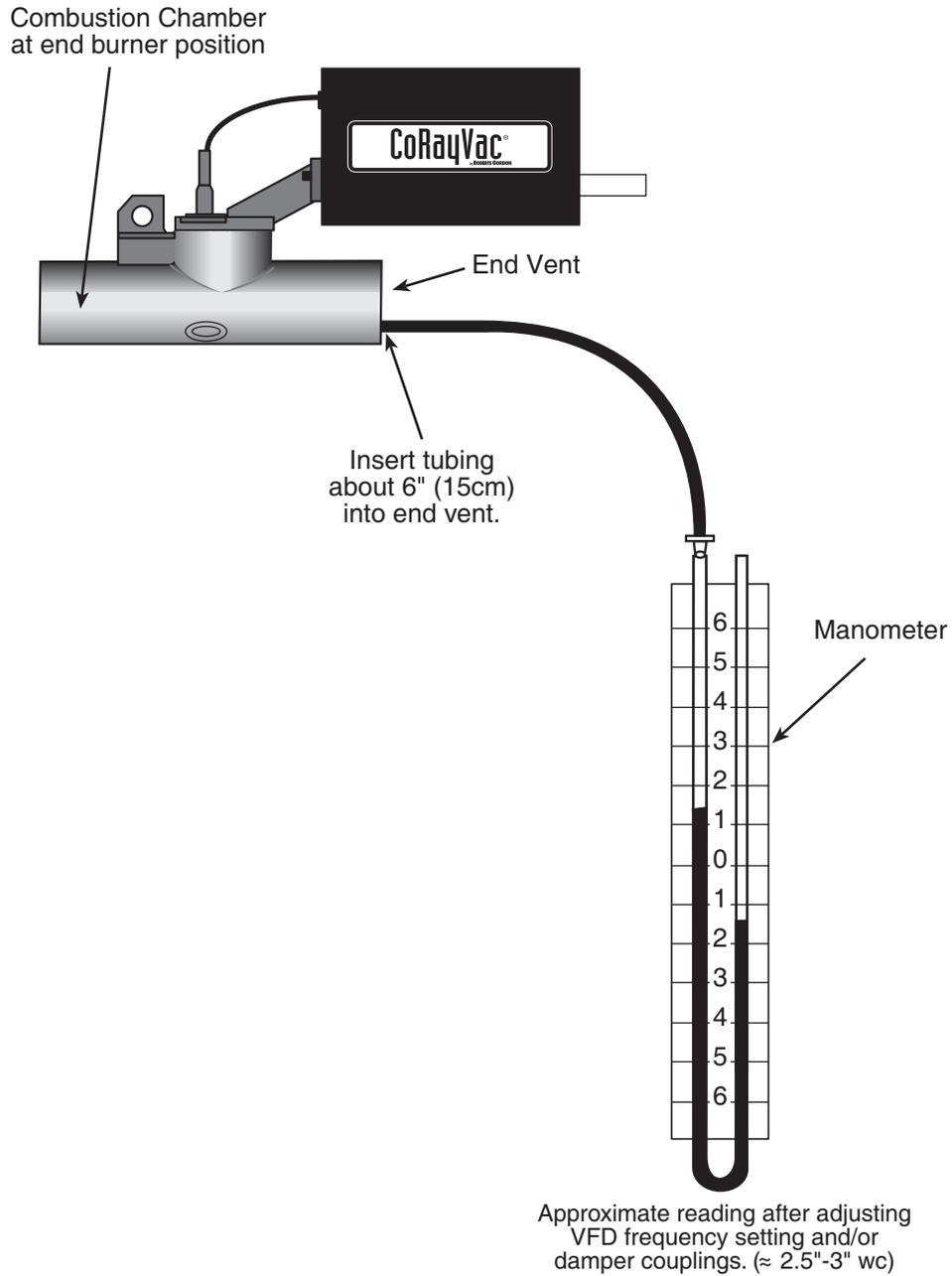
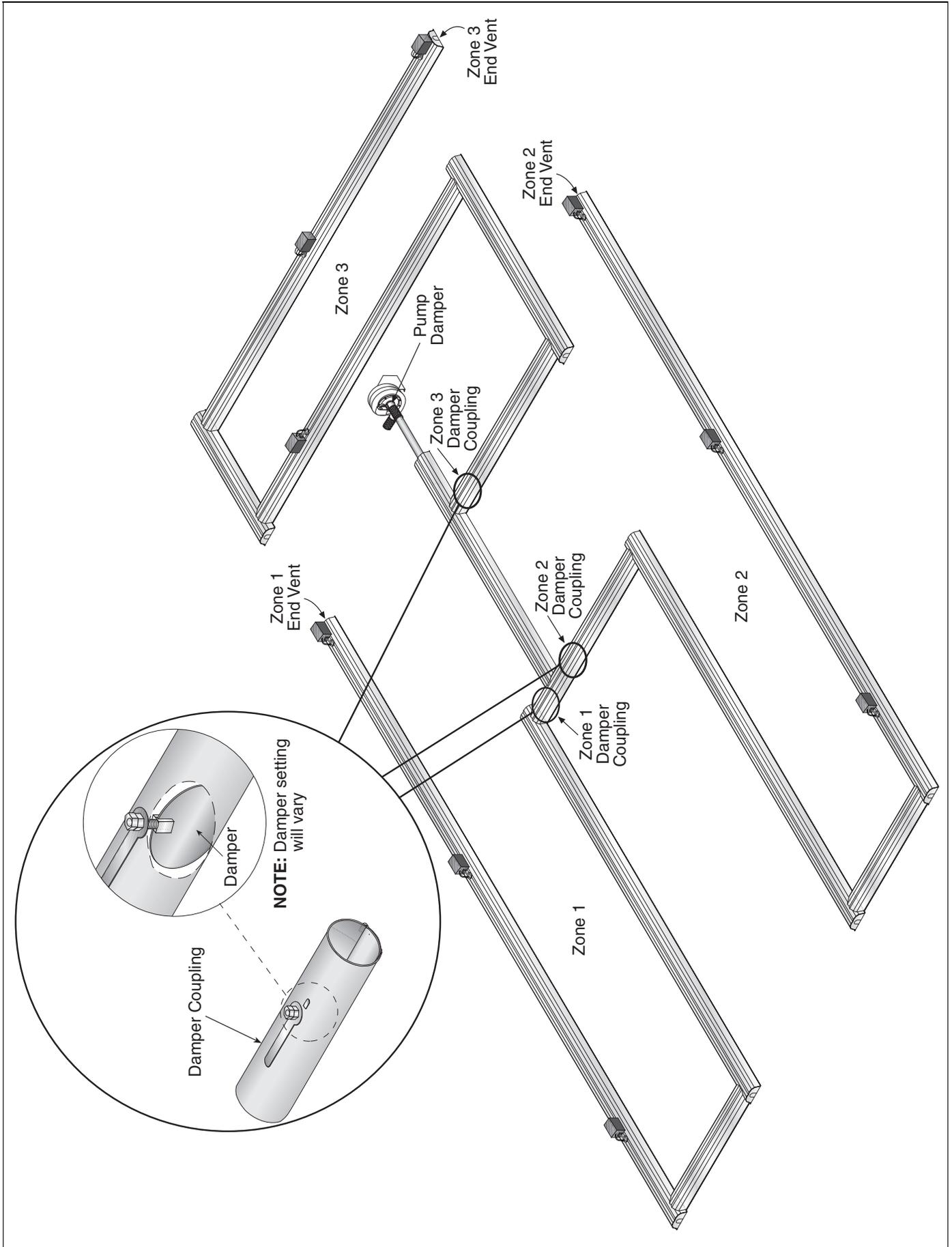


FIGURE 21: Possible Damper Couplings' Locations



Step 7.1.3 After setting end vent vacuums between 2.5" wc and 3.0" wc, while all the burners are still operating, use the down arrow button on the VFD to reduce the frequency of the output signal to the pump. Reduce the frequency of the VFD until the manometer at each of the end vents reads 1.0" wc - 1.2" wc. Make note of this frequency setting below. The frequency is found on the VFD's LCD screen.

1.0" w.c. - 1.2" wc VFD Frequency Setting

| |
|---------------------------------------|
| Record Frequency Setting Here: |
|---------------------------------------|

Step 7.1.4 Return to the PC and click the pump and zones to "OFF".

Step 7.1.5 Using the procedure described in *on Page 27, Section 6.1.1 through Section 6.1.5*, alter the following parameters on the VFD:

| Parameter Number | Parameter Name | Factory Default | New Setting |
|------------------|-------------------------|-----------------|---|
| P05 | Standard Speed Source | 01 | 03 |
| P45 | Speed at Minimum Signal | 0.0Hz | Frequency Setting noted in <i>Section 7.1.3</i> |
| P46 | Speed at Maximum Signal | 60.0Hz | Frequency Setting noted in <i>Section 7.1.2</i> |

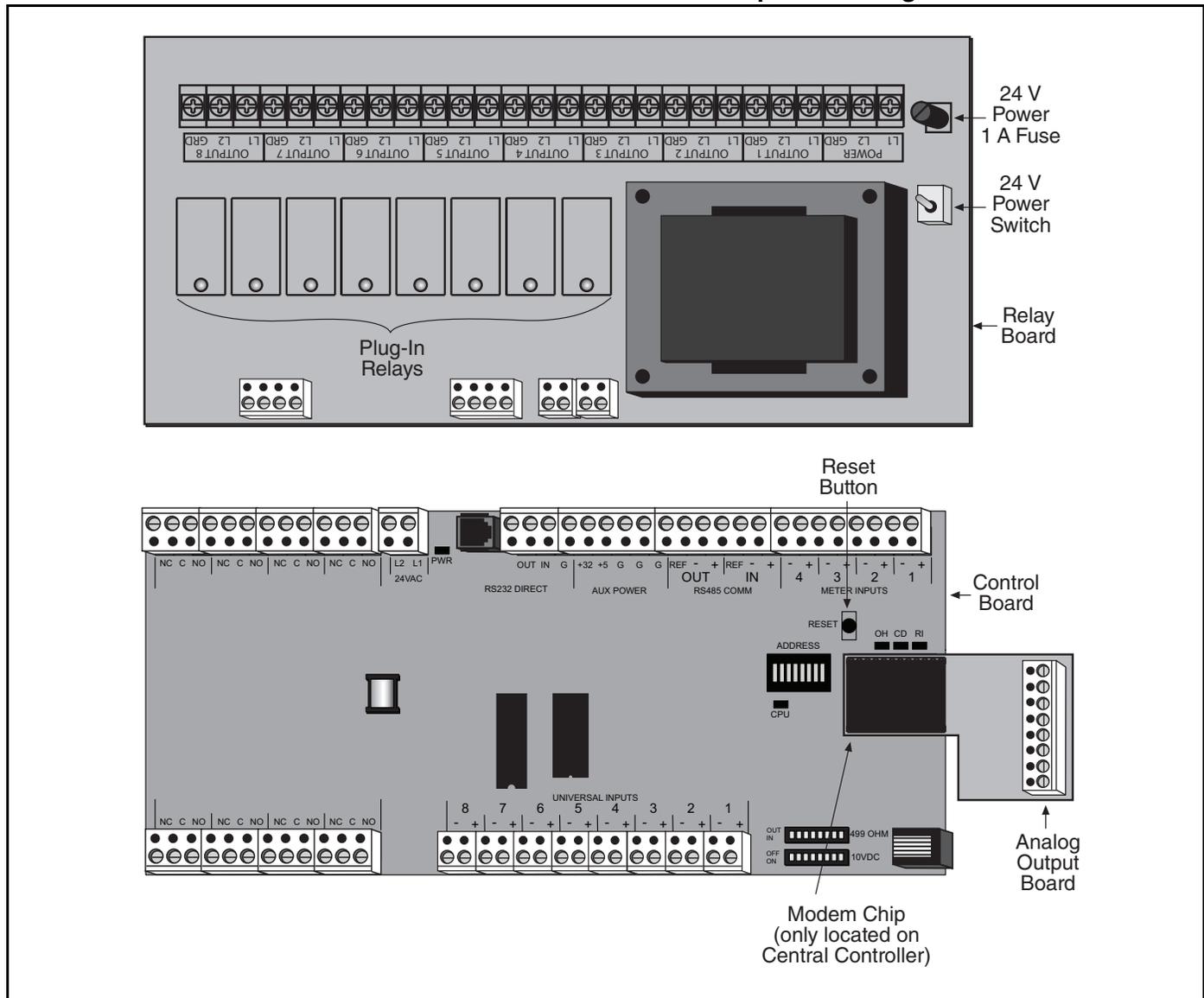
Step 7.1.6 Return to the PC and click the vacuum pump and three zones to "AUTO", then click exit.

SECTION 8: REPLACEMENT PARTS

8.1 ROBERTS GORDON® ULTRAVAC™ Controller Replacement Parts

Caution: Use only genuine ROBERTS GORDON® replacement parts. Use of parts not specified by Roberts-Gordon voids warranty.

FIGURE 22: ROBERTS GORDON® ULTRAVAC™ Controller Components Diagram



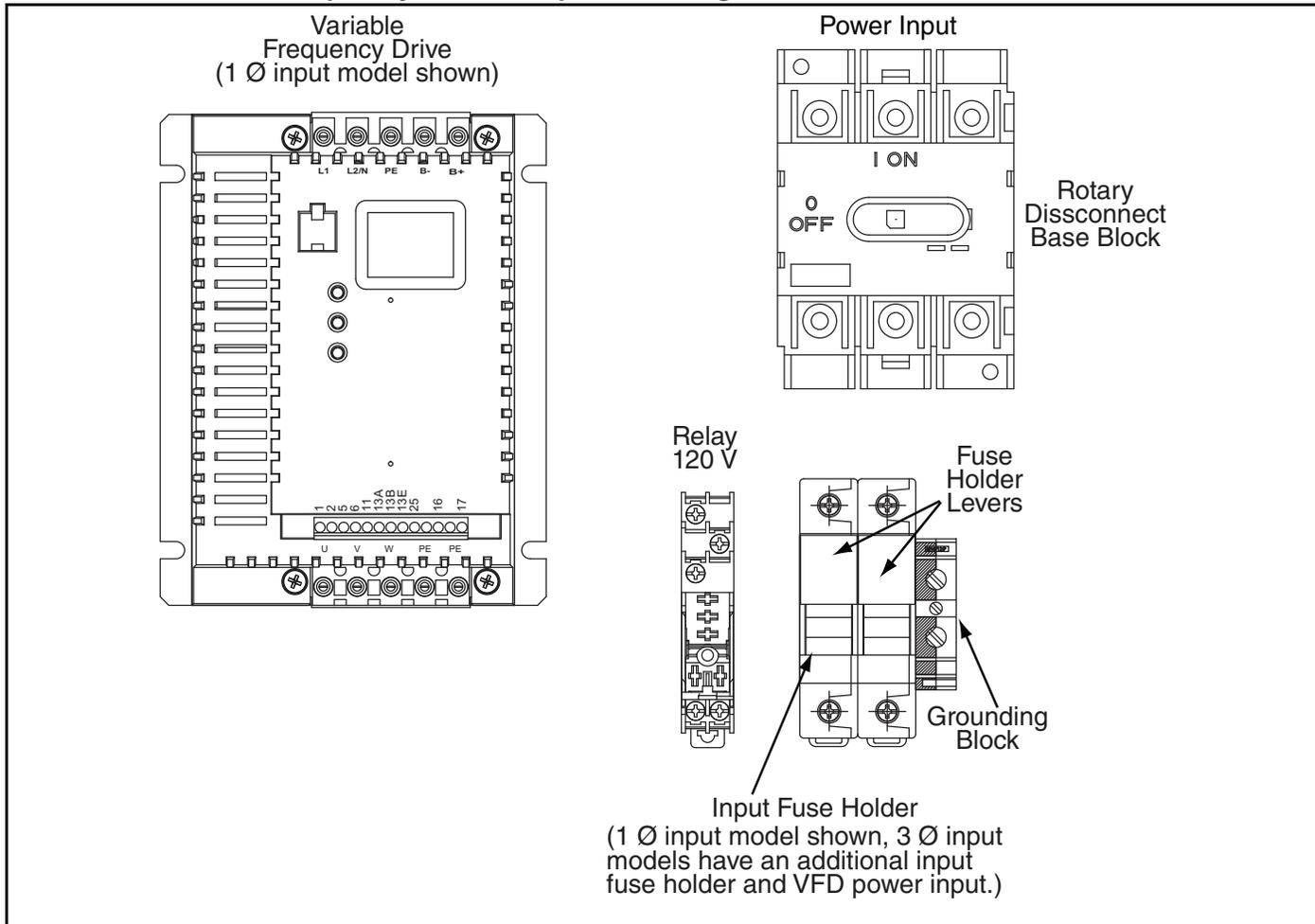
| Description | Part Number |
|--|-------------|
| Control Board (150 style) | 10080102 |
| Relay Board | 10080200 |
| Analog Output Board | 10080141 |
| URV Eprom Chip | 10080122 |
| Plug-In Relay | 10080212 |
| Modem Chip (located only on central controller) | 10080142 |
| 1 A Fuse (Relay Board) | 10080211 |
| ROBERTS GORDON® ULTRAVAC™ Indoor Sensor °F (not shown) | 10081500 |
| ROBERTS GORDON® ULTRAVAC™ Outdoor Sensor (not shown) | 10081501 |
| ROBERTS GORDON® ULTRAVAC™ Indoor Sensor °C (not shown) | 10081502 |
| PC Connection Cable Package (not shown) | 10080410 |
| RS-485 Converter Package (not shown) | 10080430 |
| TCP/IP Communication Module (not shown) | 10080440 |

| Description | Part Number |
|--|-------------|
| Comms Equalization Cable (not shown, located only on Central Controller) | 10080450 |
| Telephone Sharing Device, 4 port | 10080600 |
| Relay 120 V Unitary | 07100 |
| Lights for 150 Style Control Board | |
| Lamp Green Enclosure Mount w/o Light | 91321614 |
| Lamp Red Enclosure Mount w/o Light | 91321615 |
| Light Diode 24 Vac | 91321616 |

8.2 Variable Frequency Drive Replacement Parts

Caution: Use only genuine ROBERTS GORDON® replacement parts. Use of parts not specified by Roberts-Gordon voids warranty.

FIGURE 23: Variable Frequency Drive Components Diagram

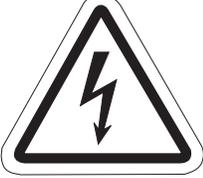


| Description | Part Number |
|--|-------------|
| Variable Frequency Drive, 1 HP, 120 V, 1 Ø Input (for use with EP-203) | 10081201 |
| Variable Frequency Drive, 3/4 HP, 230 V, 1 Ø Input (for use with EP-203) | 10081202 |
| Variable Frequency Drive, 2 HP, 230 V, 1 Ø Input (for use with EP-303) | 10081203 |
| Variable Frequency Drive, 1 HP, 460 V, 3 Ø Input (for use with EP-203) | 10081204 |
| Variable Frequency Drive, 2 HP, 460 V, 3 Ø Input (for use with EP-303) | 10081205 |
| Relay, 120 V | 90429100 |
| Fuse 10 A (for .75 HP 230 V VFD, 1 HP 460 V VFD and 2 HP 460 V VFD) | 91321410 |
| Fuse 25 A (for 1 HP 120 V VFD and 2 HP 230 V VFD) | 91321425 |
| Grounding Block | 91321300 |
| Fuse Holder | 91321400 |
| Rotary Disconnect Base Block | 91321550 |

| Description | Part Number |
|--------------------------------------|-------------|
| Rotary Disconnect Handle (not shown) | 91321551 |
| Rotary Disconnect Rod (not shown) | 91321552 |

8.3 Replacement Parts Instructions

⚠ DANGER



Electrical Shock Hazard

Disconnect electrical before servicing.

This appliance must be connected to a properly grounded electrical source.

Replace cover before operating.

Failure to follow these instructions can result in death or electrical shock.

8.3.1 Plug-In Relay

To replace the plug-in relay, turn off 120 V power to the relay board. Turn off the 24 V power switch on the relay board. Locate the malfunctioning relay and pull the relay from its socket.

Fit a new relay in the socket. Return 120 V power to the relay board and turn on the 24 V power switch on the relay board. Press the reset button on the control board and close the doors.

8.3.2 Control Board Power LED

The LED is linked to the 24 Vac input which supplies the control board with power. If the LED is not lit, there is no power to the board. If this is the case, check the 120 V power wiring to the relay board, the 24 Vac power wiring from the relay board to the control board and the 24 V power 1 A fuse.

8.3.3 10080122 Eprom Chip

The Eprom is where the controller's program (not settings) is stored. To take out the Eprom. The following steps must be taken:

Turn off the power to the control board by turning off the 24 V power switch on the relay board.

Locate the Eprom and with a small terminal screw driver placed underneath the device, pry the Eprom out of the socket.

To fit a new Eprom, look for the notch on one end of the Eprom. There is a notch on the socket and a notch on the Eprom. The Eprom should be fit so that the notch on the socket and the Eprom are aligned.

Turn on the 24 V power switch on the relay board, press the reset button on the control board and close the doors.

8.3.4 24V Power 1 A Fuse

To replace the 1 A fuse, turn off power to the relay board and turn off the 24 V power switch on the relay board.

Locate the 1A fuse and remove it from its socket using a flathead screwdriver. Twist the fuse a 1/4 turn counter-clockwise until the fuse pops out of the socket. Replace it with a new fuse.

Slide the fuse back into the socket, press down and turn the fuse a 1/4 turn clockwise until secure.

Return 120 V power to the relay board and turn on the 24 V power switch on the relay board. Press the reset button on the control board and close the doors.

8.3.5 Variable Frequency Drive (VFD)

To replace the Variable Frequency Drive, turn off all power to the drive assembly at the breaker or disconnect switch. Turn off 120 V power to the relay board inside the ROBERTS GORDON® ULTRAVAC™ Controller. Turn off the 24 V power switch on the relay board.

Mark all wires connected to the VFD, noting the terminals that they are secured to. Remove all wires from the VFD terminals.

Remove the VFD from its mounting plate by removing the four securing screws.

Verify that the input voltage noted on the rating plate of the VFD matches the input voltage of the old VFD. Secure the new VFD to the mounting plate with the four screws. Return all wires to the correct VFD terminals. If possible, it may be easier to partially re-wire the new VFD before mounting it to the mounting plate.

Close the door and return power to the VFD. Return 120 V power to the relay board. Turn on the 24 V power switch on the relay board. Press the reset button on the control board and close the doors.

8.3.6 Variable Frequency Drive 25 A or 10 A Fuse

To replace a fuse, turn off input power to the variable frequency drive assembly at the breaker or disconnect switch.

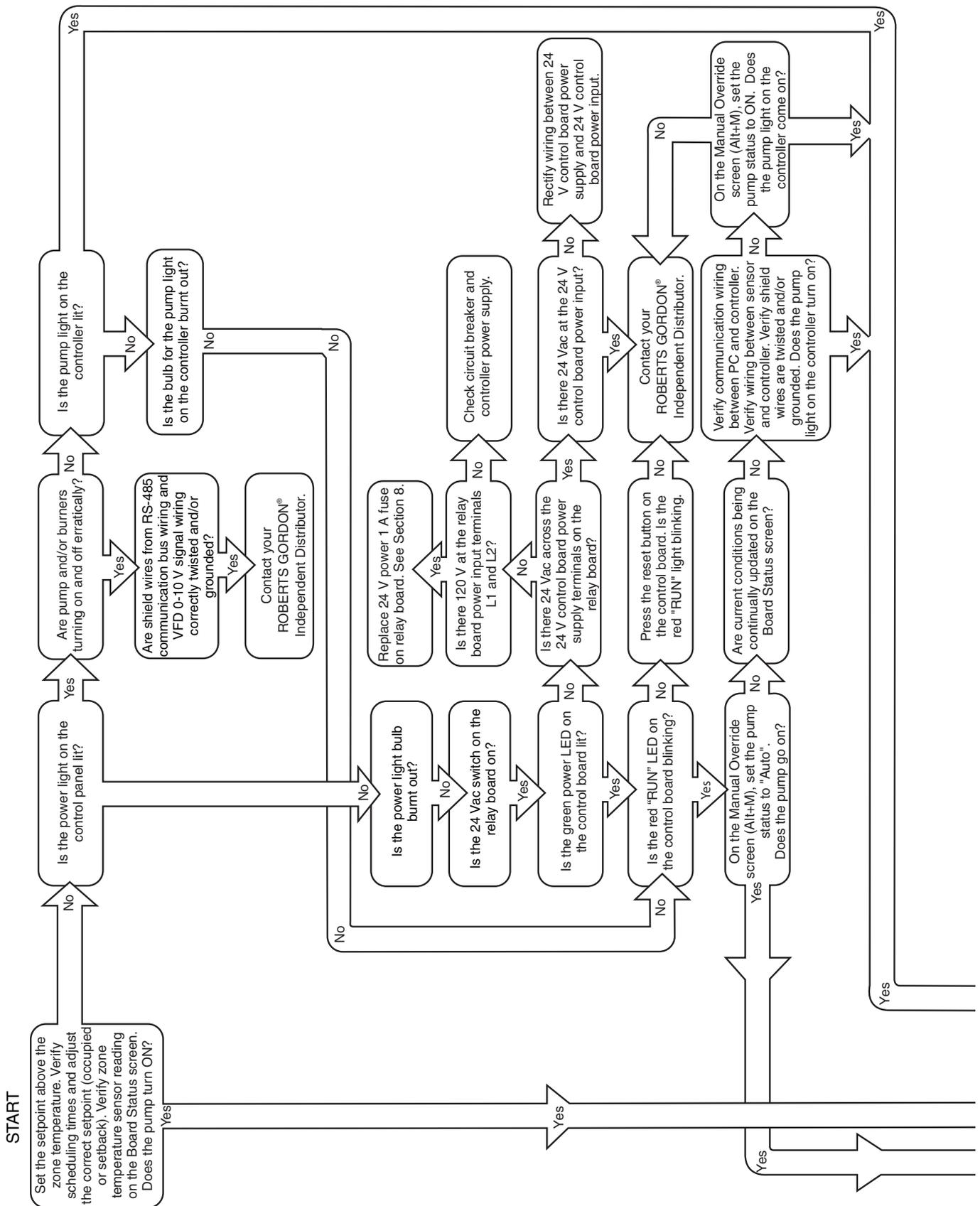
Turn off 120 V power to the relay board inside the ROBERTS GORDON® ULTRAVAC™ Controller. Turn off the 24 V power switch on the relay board.

Inside the VFD assembly, open the fuse holder by pulling down the lever to expose the fuse. Remove the old fuse and insert a new fuse. Verify the correct fuse rating, 25 A for 1 HP 120 V VFD or 2 HP 230 V VFD, 10 A for the .75 HP 230 V VFD, 1 HP 460 V VFD and 2 HP 460 V VFD. Close the fuse holder. Return power to the VFD assembly and verify that the VFD LCD screen is on. (dashes displayed). Close the VFD assembly door.

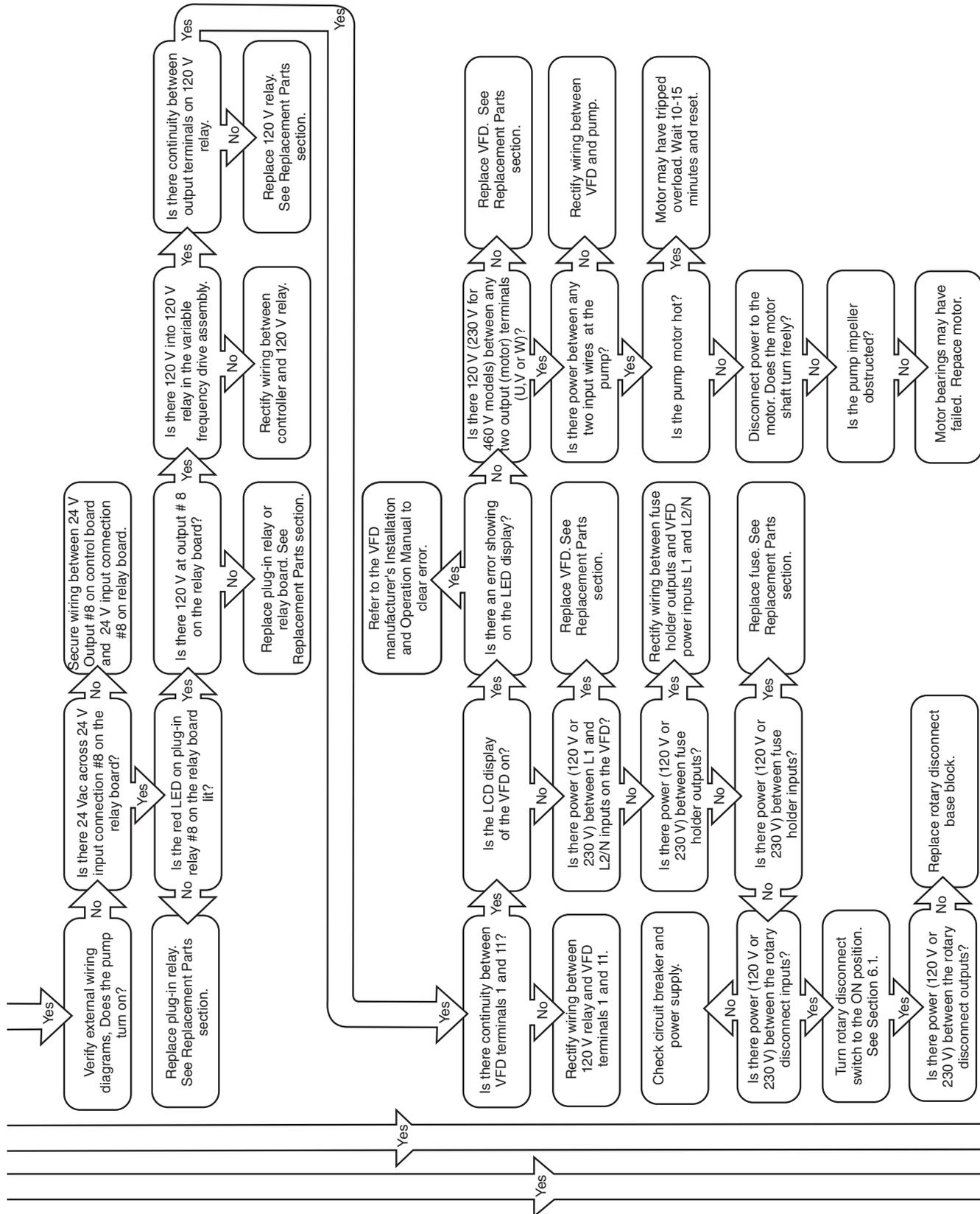
Return 120V power to the relay board. Turn on 24 V power switch on the relay board. Press the reset button on the control board and close the doors.

SECTION 9: TROUBLESHOOTING

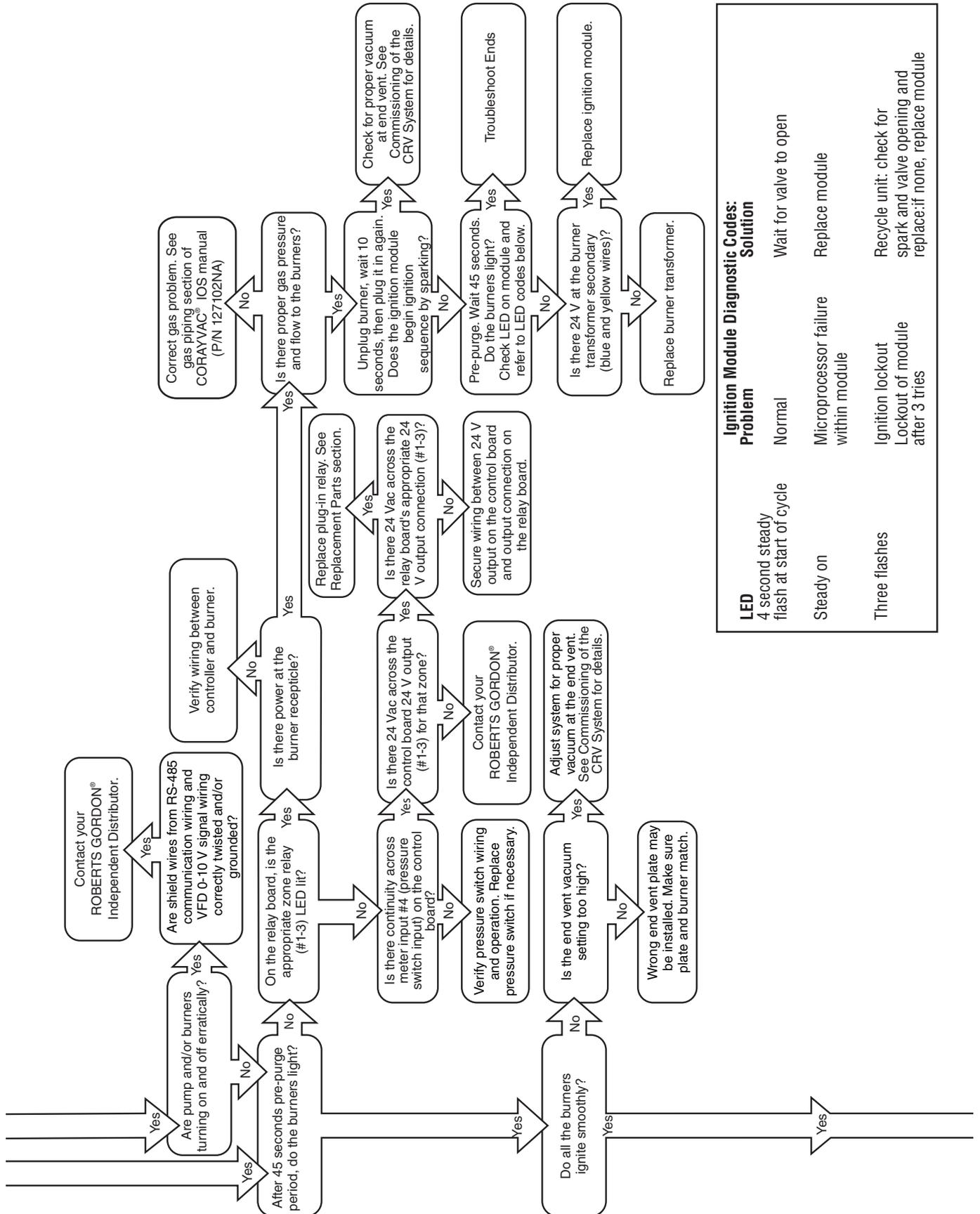
FIGURE 24: Troubleshooting Flow Chart



Troubleshooting Flow Chart (continued)

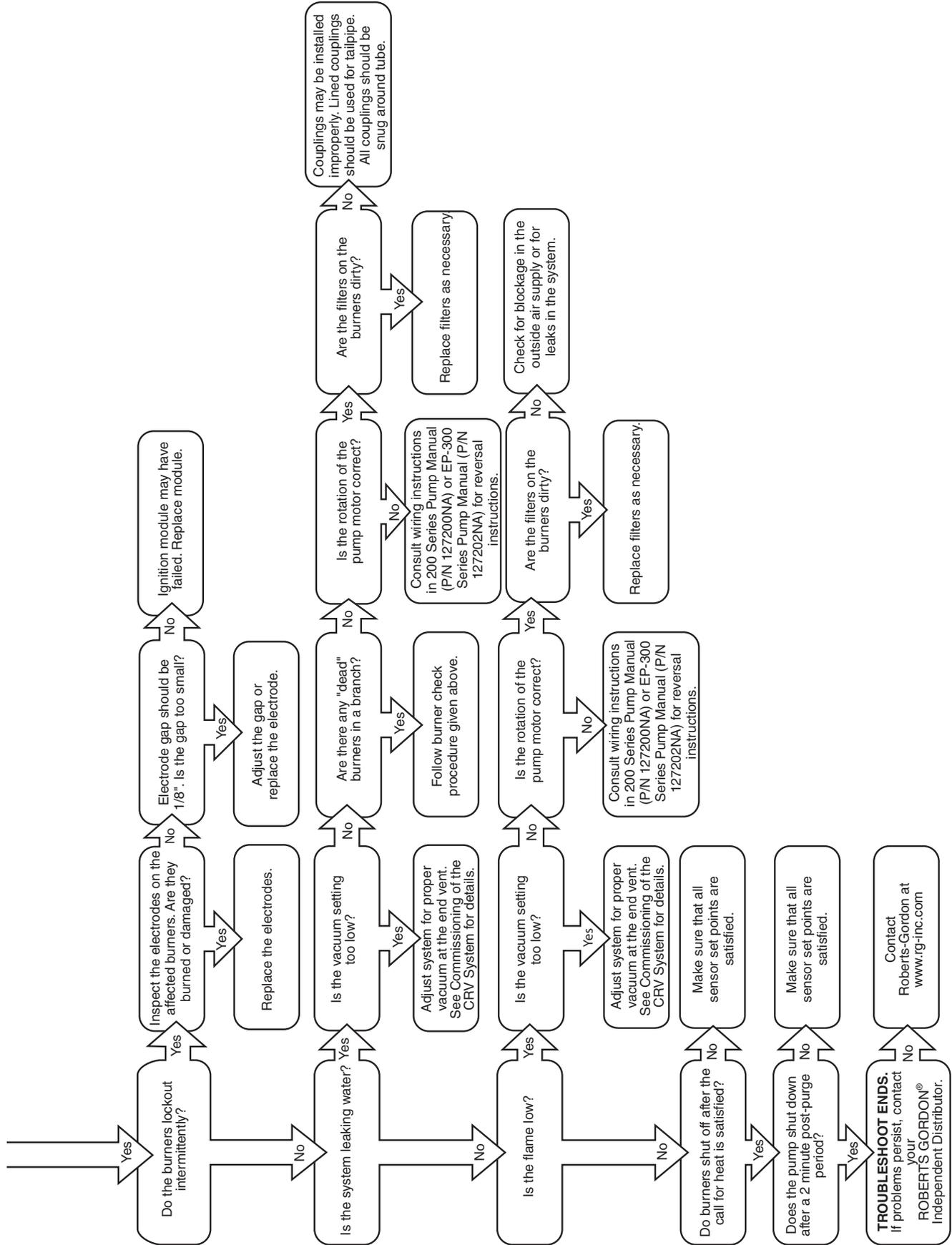


Troubleshooting Flow Chart (continued)



| LED | Problem | Ignition Module Diagnostic Codes: | Solution |
|---|---|-----------------------------------|---|
| 4 second steady flash at start of cycle | Normal | | Wait for valve to open |
| Steady on | Microprocessor failure within module | | Replace module |
| Three flashes | Ignition lockout Lockout of module after 3 tries | | Recycle unit: check for spark and valve opening and replace:if none, replace module |

Troubleshooting Flow Chart (continued)



SECTION 10: THE ROBERTS GORDON® ULTRAVAC™ LIMITED WARRANTY**ROBERTS-GORDON WILL PAY FOR:**

Within 42 months from date of shipment from Roberts-Gordon, replacement parts will be provided free of charge for any part of the controller which fails due to a manufacturing or material defect.

Roberts-Gordon will require the part in question to be returned to the factory. Roberts-Gordon will, at its sole discretion, repair or replace after determining the nature of the defect and disposition of part in question.

ROBERTS GORDON® Replacement Parts are warranted for a period of 18 months from date of shipment from Roberts-Gordon or the remaining ROBERTS GORDON® ULTRAVAC™ warranty.

ROBERTS-GORDON WILL NOT PAY FOR:

Service trips, service calls and labor charges.

Shipment of replacement parts.

Claims where the total price of the goods have not been paid.

Damage due to:

- Improper installation, operation or maintenance.
- Misuse, abuse, neglect, or modification of the ROBERTS GORDON® ULTRAVAC™ in any way.
- Use of the ROBERTS GORDON® ULTRAVAC™ for other than its intended purpose.
- Incorrect gas or electrical supply, accident, fire, floods, acts of God, war, terrorism, or other casualty.
- Improper service, use of replacement parts or accessories not specified by Roberts-Gordon.
- Failure to install or maintain the ROBERTS GORDON® ULTRAVAC™ as directed in the Installation, Operation and Service manual.
- Relocation of the ROBERTS GORDON® ULTRAVAC™ after initial installation
- The use of the ROBERTS GORDON® ULTRAVAC™ in a corrosive atmosphere containing contaminants.
- The use of the ROBERTS GORDON® ULTRAVAC™ in the vicinity of a combustible or explosive material.
- Any defect in the ROBERTS GORDON® ULTRAVAC™ arising from a drawing, design, or specification supplied by or on behalf of the consumer.
- Damage incurred during shipment. Claim must be filed with carrier.

WARRANTY IS VOID IF:

The ROBERTS GORDON® ULTRAVAC™ is not installed by an electrician qualified in the installation and service of control systems for heating equipment.

You cannot prove original purchase date and required annual maintenance history.

The data plate and/or serial number are removed, defaced, modified or altered in any way.

The ownership of the ROBERTS GORDON® ULTRAVAC™ is moved or transferred. This warranty is nontransferable.

Roberts-Gordon is not permitted to inspect the damaged controller and/or component parts.

READ YOUR INSTALLATION, OPERATION AND SERVICE MANUAL

If you have questions about your controller, contact your installing professional. Should you need Replacement Parts or have additional questions, call or write Roberts-Gordon:

U.S.A.

1250 William Street

P.O. Box 44

Buffalo, New York 14240-0044

716.852.4400

On the web at: www.rg-inc.com

Roberts-Gordon's liability, and your exclusive remedy, under this warranty or any implied warranty (including the implied warranties of merchantability and fitness for a particular purpose) is limited to providing replacement parts during the term of this warranty. Some jurisdictions do not allow limitations on how long an implied warranty lasts, so this limitation may not apply to you. There are no rights, warranties or conditions, expressed or implied, statutory or otherwise, other than those contained in this warranty.

Roberts-Gordon shall in no event be responsible for incidental or consequential damages or incur liability for damages in excess of the amount paid by you for the ROBERTS GORDON® ULTRAVAC™. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so this limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from jurisdiction to jurisdiction.

Roberts-Gordon shall not be responsible for failure to perform under the terms of this warranty if caused by circumstances out of its control, including but not limited to war, fire, flood, strike, government or court orders, acts of God, terrorism, unavailability of supplies, parts or power. No person is authorized to assume for Roberts-Gordon any other warranty, obligation or liability.

LIMITATIONS ON AUTHORITY OF REPRESENTATIVES:

No representative of Roberts-Gordon, other than an Executive Officer, has authority to change or extend these provisions. Changes or extensions shall be binding only if confirmed in writing by Roberts-Gordon's duly authorized Executive Officer.

