

# ENERVEX HRC80 CONTROLLER

3912011 05.17

Installation & Operating Manual



**READ AND SAVE THESE INSTRUCTIONS!**



UL File E479365

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VENTING DESIGN SOLUTIONS



This symbol shows that the ENERVEX HRC80 Controllers are listed in the US and certified for Canada under Underwriters Laboratories Inc. file no. E479365.

### Symbol Legend

The following terms are used throughout this manual to bring attention to the presence of potential hazards, or to important information concerning the product.

 **DANGER:** Indicates an imminent hazardous situation which, if not avoided, will result in death, serious injury or substantial property damage.

 **WARNING:** Indicates an imminent hazardous situation which, if not avoided, may result in personal injury or property damage.

 **DANGER:** Indicates an imminent electrical shock hazard which, if not avoided, will result in death, serious injury or substantial property damage.

### How to use this manual

This installation manual does not contain any system design documentation. System design documentation is available from any authorized ENERVEX representative. Accessories, fans, and variable frequency drives are not covered by this manual. Please refer to these component's individual manuals.

### TO REDUCE THE RISK OF FIRE, ELECTRICAL SHOCK OR INJURY TO PERSONS, OBSERVE THE FOLLOWING:

1. Use this unit in the manner intended by the manufacturer. If you have questions, contact the manufacturer at the address or telephone number listed on the front of the manual.
2. Before servicing or cleaning the unit, switch off at service panel and lock service panel to prevent power from being switched on accidentally.
3. Installation work and electrical wiring must be done by a qualified person(s) in accordance with applicable codes and standards.
4. Follow the appliance manufacturer's guidelines and safety standards such as those published by the National Fire Protection Association (NFPA), and the American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), and the local code authorities.
5. This unit must be grounded.

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## 1. PRODUCT INFORMATION

### 1.1 Introduction

These instructions provide both general guidelines and special requirements for all parts in the HRC80 product line. Before specifying a design or beginning an installation please carefully review these instructions. Contact local building or fire officials about restrictions and installation inspection in your area.

### 1.2 Description

The HRC80 is a totally integrated heat recovery control system designed to control and monitor heat recovery.

The HRC80 is designed to work with the ENERVEX VHX Heat Recovery system. It monitors inlet and outlet water and flue temperatures and limits the maximum water outlet temp to a desired level while maximizing heat recovery and efficiency. This controller can be used in conjunction with most ENERVEX draft controls.

The integrated bypass damper control features full modulating capabilities providing tighter control and added safety. Inlet and outlet flue temperatures are constantly monitored and the bypass damper will dynamically respond to water outlet temperature.

The HRC80 features a series of set points allowing maximum flexibility. The bypass set point maintains a maximum allowable water temperature. The bypass modulates open or closed as the water temperature fluctuates around the set point. The HRC80 can interlock pump and is capable of controlling a modulating water valve to maintain desired water temperature. A dry contact input communicates when there is a need for boiler feed water or to maintain a hot water tank or deaerator.

The Controller features a panel mounted, 132x64 pixel LCD graphic display used to interface, monitor and control all aspects of the application.

The housing is made of steel and is NEMA 1 rated with a removable white painted mounting panel. The controller housing can also be supplied as NEMA 12 rated without an external display. The housing is finished with an ANSI 61 gray polyester powder coating.

### 1.3 Components

The HRC80 consists of the following components:

- Control Box
- Temperature Sensors (4)
- Installation Manual

### 1.4 Shipping

The HRC80 units are shipped in a carton box.

If other components are shipped, they will appear on the shipment packing list.

### 1.5 Accessories (Optional)

- Flowmeter
- Modulating water valve

### 1.6 Listings

The HRC80 Controller is UL Listed in the U.S. and certified for Canada under Underwriters Laboratories Inc. file no. E479365:

- UL 508A Standard for Industrial Control Panel
- CSA-22.2 No. 14 Industrial Control Equipment

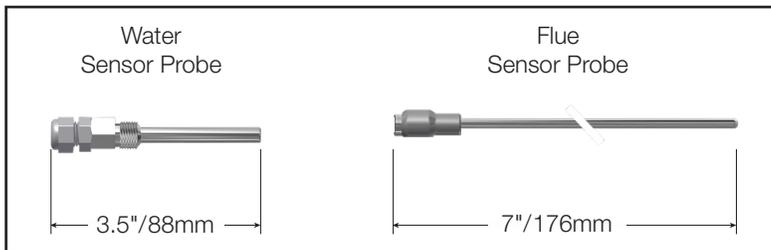
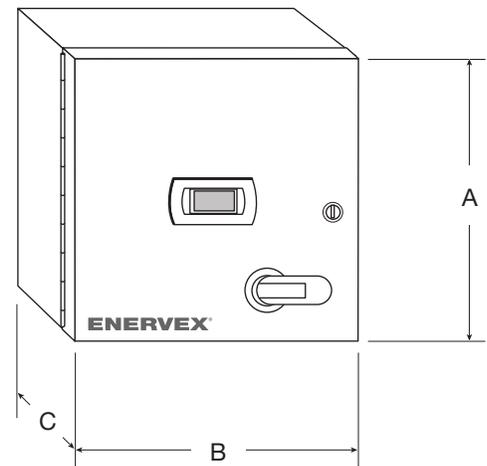
### 1.7 Warranty

2-year factory warranty (see back cover). Complete warranty conditions are available from ENERVEX Inc.

## 2. SPECIFICATIONS AND DIMENSIONS

### 2.1 Specifications

Model		HRC80
Power Supply	VAC	1x120
Amperage	A	10
Operating Temperature	°C / °F	-10 to 60 / 14 to 140
Water Temp Sensors (2)	NTC	0 to 150°C / -58 to 302°F
Flue Temp Sensors (2)	PT1000	-50 to 350°C / -58 to 662°F
D.I. (2) (Volts Free Contacts)		5 mA Max
Max Sensor Cable Length	m / ft	10/32
Analog Outputs (2)	VDC	(0-10)
Resolution	bit	8
Precision	%	±2% of full scale
D.O. (N.O.) (4)	Resistive (A)	1
	Inductive (A)	1
	Max VAC	250
Dimensions	A in / mm	16 / 400
	B in / mm	16 / 400
	C in / mm	8 / 200
Weight	lbs / Kg	26 / 11.8



Sensor Probes: (2) each included

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### **3. MECHANICAL INSTALLATION**

#### **3.1 General**

The interconnecting signal cables between the HRC80 panel and field devices should be located as far as possible from high voltage wiring and large electrical equipment. Items like the ignition cable and combustion air fan motor can introduce voltage spikes which could alter the operation of the controller. The signal cables should be run at right angles to any power wiring and must not be routed with any appliance wiring.

#### **3.2 Mounting of Control**

The Control Panel may be mounted on a wall, or a convenient post. To avoid excessive heat or vibration, it should not be mounted directly on the appliance. Also, it must be located away from large or high voltage equipment such as power distribution panels, motors, ignition transformers, etc. Installing it close to the boiler in question is usually convenient since it will allow the operator, when working on the controls, to directly see the effects of their actions. Where ventilated enclosures are used, there should be venting above the drive and below the drive to ensure good air circulation. Air should be drawn in below the drive and expelled above the drive.

#### **3.3 Mounting of Temperature Sensors**

There are four temperature sensors. Two flue gas high temperature sensors (PT1000) and two Hi-Temp water sensors (HT-NTC). Install the flue gas temperature sensors before and after the economizer. The minimum recommended distance is three times the diameter (3xD) of the flue. Temperature sensors are installed on the water lines inlet and outlet of the heat exchanger. The water temperature sensors should be installed as practically close as possible to the heat exchanger. See Appendix C.

#### **3.4 Mounting of Flowmeters (If applicable)**

A flowmeter is an optional, but highly recommended accessory. There are multiple models available depending on flow and pipe size. The Flowmeter should be installed at the inlet of the heat exchanger.

## 4. ELECTRICAL INSTALLATION

### 4.1 Wiring and Terminal Descriptions

The control panel requires 120 VAC, 10 A. All wiring must conform to the National Electrical Code (NEC), and all applicable local codes. The enclosure meets UL508A Industrial Control Panel wiring safety standard. See Fig. 1 below for a detailed connection diagram and list of terminals.

**DANGER**



Turn off electrical power before servicing. Contact with live electric components can cause shock or death.

**IMPORTANT**



To avoid electromagnetic interference, keep sensors and digital input cables separated from the power cable as much as possible (at least 2 in.) Never run power cables and sensor or low voltage cables in the same conduit.

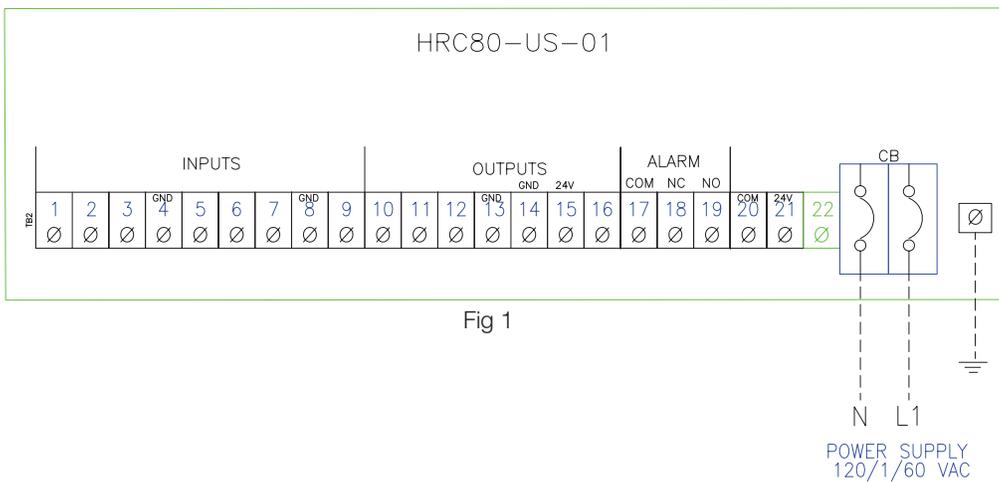


Fig 1

Terminal No.	Description	Input/Output	Signal Range	Terminal No.	Description	Input/Output	Signal Range
1	Water Temp Inlet	AI	HT NTC	12	Appliance Call	Input	Dry Contact
2	Water Temp Outlet	AI - HT NTC	HT NTC	13	Ground (GND)	GND	GND
3	Flue Temp Inlet	AI	PT1000	14	Pump Relay (OPT.)	GND	GND
4	Ground (GND)	GND	GND	15	Pump Relay (OPT.)	Output	24V AC
5	Flue Temp Outlet	AI	PT1000	16	Spare	Spare	Spare
6	Flowmeter (OPT.)	AO	2-10 VDC	17	Building Alarm	Output	Com
7	Pump Signal	DI	Dry Contact	18	Building Alarm	Output	NC Contact
8	Ground (GND)	GND	GND	19	Building Alarm	Output	NO Contact
9	Draft Control Alarm	Input	Dry Contact	20	24V Common	GND	GND
10	Mod Bypass Damper	Output	2-10 VDC	21	24V AC	Output	24V AC
11	Mod Water Valve	Output	2-10 VDC	22	GND	GND	GND

Table 1

For information on how to connect the sensors and other peripherals see Appendix B for WD and CD wiring examples at the end of this manual. The table at right shows the recommended wire sizes for remote connections of sensors and low voltage signals.

Type	AWG for Section <160ft	AWG for Section <130ft
NTC	20	18
PT1000	18	16
I(Current)	22	20
V(Voltage)	22	20

Table 2

## 5. STARTUP AND CONFIGURATION

### 5.1 DDC Overview

The HRC80 main purpose is to control the bypass damper of the economizer while maximizing energy efficiency of the system. The system monitors the temperature of the water at the outlet of the economizer. The bypass remains closed while the outlet water temperature is below the given set point. Once the set point is reached, then the bypass starts modulating the bypass damper to maintain set point while maximizing heat recovery. The system can interlock a pump and can control a water side modulating valve. If the water temperature reaches the system temperature alarm limits, the bypass opens completely to prevent an overheating condition. The bypass will close back down and continue normal control after the water temperature falls below the threshold.

### 5.2 HMI Screens

The HMI displays all the information related to the HRC80 system. There are several screens that are used to view, set and/or change the system parameters.

### 5.3 Main Menu Screen

Fig. 2 at the right shows the HMI portion of the HRC80 control. This is also the main screen of the controller. The icon on the bottom right-hand corner of the screen illustrates additional submenus accessible via the up or down button on the right. Pressing ENTER allows access the next level. The PRG button, on the left allow access to the setup screen. This is the password protected section of the controller. The ALARM button displays the existing alarms. The ESC button takes you back one screen at a time. The UP, ENTER and DOWN buttons allow navigation through the different parts of the controller. See Keypad Functions on Table 3 on page 9.

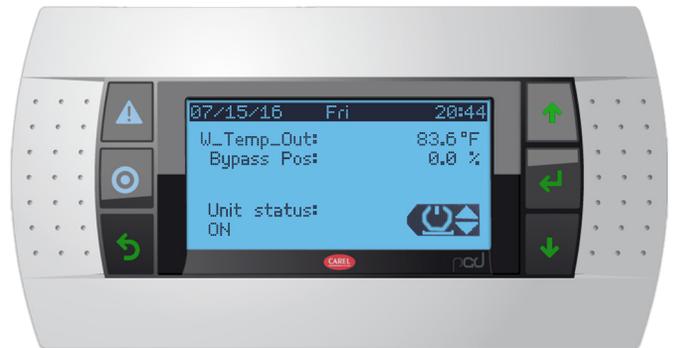


Fig 2

Button	Description	Backlighting	Functions
	ALARM	White/Red	Displays existing alarms/Resets alarms
	PRG	White/Yellow	Access password protected menu items
	ESC	White	Go back one level
	UP	White	Increases the value/Navigate to previous screen
	ENTER	White	Confirms the value
	Down	White	Decreases the value/Navigate to next screen

Table 3

In addition, there are four digital buttons described below:



ON/OFF Button



Export Logs Button - Sets the data logging functions



Info Button - Temperature, Pump, Water flow, and Software/Hardware info.



Set Points Button - Set point setting for Bypass and Mod Water Valve Control

The digital ON/OFF button is located on the bottom right-hand corner of the controller. Pressing ENTER while this digital button is visible allows the user access to enabling or disabling the controller by turning it ON or OFF. See Fig. 3. The controller can be set to ON/OFF manually, via the keypad or by an external “call for heat” from a Digital Input (DI). When the controller is ON normal operation resumes. The bypass damper and/or water modulating valve modulates to maintain set point. If there is a circulating pump, it will get turned on as well.

### 5.4 System Temperature Monitoring

Fig. 4 shows the Temperature Information screen. These are real time measurements of the water inlet and outlet as well as flue inlet and outlet temperatures.

W\_Out: Outlet Water Temp

W\_In: Inlet Water Temp

F\_Out: Flue Outlet Gas Temp

F\_In: Flue Inlet Gas Temp



Fig 3

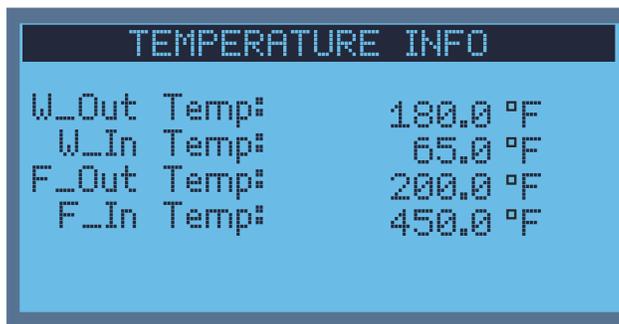


Fig 4

### 5.5 System Temperature Setting

The temperature set point can be entered from the “Set” icon. Pressing Enter displays the “Bypass Set” screen. See Fig. 5.



Fig 5

### 5.6 System Configuration Screens

The System Config screen is shown on Fig. 6 and can be accessed by pressing the “Program” button. See Fig. 2 on page 8 for the location of the Program button.

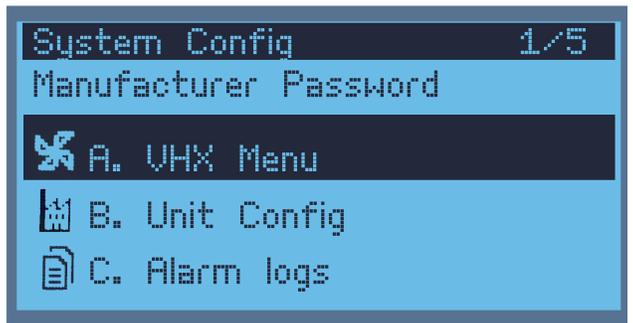


Fig 6

Pressing the “VHX Menu” accesses the “Additional Settings” screen. These screens allow the operator to access PID parameters and Alarm limit setting screens. Also, to add optional parts such as a flowmeter and modulating water valve.

See the “Additional Settings” screens at right. The pump and modulating water valve are optional items that can be added to the system as needed. See Fig. 7.

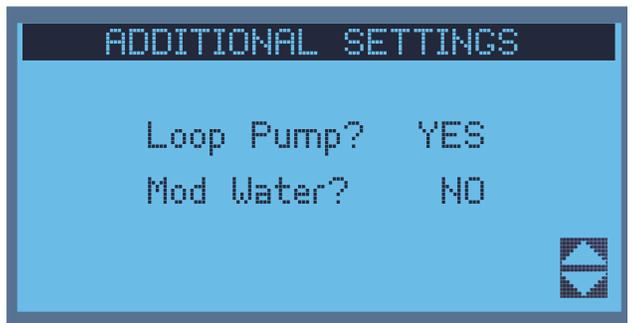


Fig 7

The flowmeter is an optional item that can be added to the system as needed. See Fig. 8.



Fig 8

The HRC80 uses a PID control system. When setting up the PID parameter the user needs to understand the sequence of implementing them. The parameters displayed at right are default values, but a PID tuning must be performed as needed. Fig. 9 shows the PID parameters required to control the Bypass damper.



Fig 9

PID Parameters for the water modulating valve, if selected. See Fig. 10.

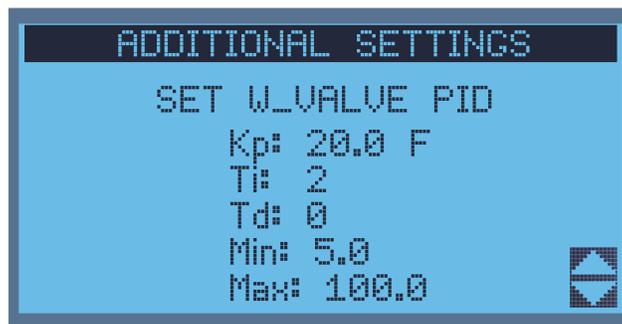


Fig 10

When the water temperature reaches or exceeds the alarm limits, the controller enters the alarm mode, opening the bypass 100%. This mode also activates the alarm contacts. Terminals 17-18-19 are a N.C/C/N.O. dried set of contacts for the building alarm. Fig. 11 shows the screen to set the alarm limits.



Fig 11

Selecting “Unit Configuration” allows the operator to access the configuration screens. Import and Export of configuration files can be selected, loaded and downloaded to/from the controller via the micro-USB connector or to an internal flash memory allocated for this purpose. See Fig. 12 and 13.

### 5.7 Alarm Screen

Fig. 14 displays the current alarm status of the system. The Alarm screen can be accessed pressing the ALARM button. See Fig. 2 for the location of the ALARM button. Conditions in Alarm are displayed on the screen. Alarms will show on the display if they are active. The alarms can be reset by holding the ALARM button down for 3 seconds. The alarms are displayed with the date and time of their occurrence. Pressing enter here will take the user to the Alarm History Screen. See Fig. 15.

See below a list of the possible Alarm conditions:

- Water too Hot!
- Water too Cold!
- Draft Alarm!

NOTE: Setting the Max and Min Temperature Alarms require program changes.

There are two more DDC-related alarms: “Too many mem writings” and “Retain mem write error”. These two alarms pertain to the memory of the systems and should not interfere with the systems operation.

### 5.8 Alarm History Screen

This screen displays the alarm history of the system. The alarms are displayed with the date and time of their occurrence. See Fig. 15. This screen can be accessed from the Alarm Screen or from the Program -> VHX Menu -> Alarm logs Menu.



Fig 12



Fig 13



Fig 14



Fig 15

## 5.9 Control Panel

The HRC80 is an Industrial Control Panel using UL rated components and designed with safety in mind. The panel consists of typical components such as: HMI Display, DDC Module, 120V/24V transformer, relays, circuit breakers, disconnects, etc.

## 5.10 Placing System into Operation

It is suggested the following sequence be used when the HRC80 is started for the first time. If, at any time, the expected result is not obtained, call ENERVEX Technical Support.

Before applying power to the unit inspect all control and power voltage wiring.

Supplying Power to the System:

1. Check that the supplied voltage is 120 VAC (+/- 10%).
2. Turn on the main power using the door disconnect. The DDC will power up.

## 5.11 System Configuration

The system needs to be configured to reflect the various options that have been selected for the installation.

1. A pump, flowmeter and modulating water valve are optional features. If any of them are employed, then navigate to the required screens by pressing Program->Password (Initially= "0000")->VHX Menu. This screen allows the user to set the pump and/or the Modulating water valve. Press Enter, then UP/DOWN to select YES. NO is the default selection, then press Enter.
2. Once the cursor is on the top left-hand corner, pressing the UP/DOWN buttons takes you to the next screen. The next screen allows the user to set the flowmeter. Press Enter to set the cursor at the next prompt: "Flowmeter?", and scroll UP/DOWN to select YES. NO is the default selection. Pressing Enter moves the cursor to the next prompt and select the flowmeter model desired. This will indirectly set the appropriate flow range on the controller.
3. Once the cursor is on the top left hand corner of the HMI, press UP/DOWN to navigate to the next screen to SET BYPASS PID parameter and/or SET W\_VALVE PID. See appendix B for help tuning a PID controller.
4. The following screen is the ALARM LIMIT TEMPS. Press Enter and scroll UP/DOWN to set the desired low and high temp alarms. Factory default values are low limit = 32 °F and high limit = 212 °F.
5. Then press ESC twice to leave the password menu section and go back to the main screen. Press DOWN three times. The "Set" digital button will appear on the lower right-hand corner of the HMI.
6. Press Enter and set the desired water temp Set point. The bypass will remain closed until this temperature is reached. If maintaining water temperature is not the ultimate purpose, but maximizing energy, then set the water temp as high as safely possible to keep the bypass closed as long as possible.

### 5.12 Logout of the Password Protected Menu

After all configuration steps have been taken and finished, logging out of the menu is recommended. Pressing ESC backs out of the menu, but doesn't log out. If a log out is not performed, the controller will time out and auto log out after 3 mins. To log out navigate to the "Log Out" screen as shown in Fig. 16 and press Enter.



Fig 16

## 6. MAINTENANCE AND TROUBLESHOOTING

### 6.1 Basic Troubleshooting

Very little maintenance should be required for the HRC80 system. The table below serves as a troubleshooting guide and information.

Problem	Possible Cause	Action
No display at HMI	Power failure/HMI Cord	Check supply voltage to the panel is 120 VAC +/-10%
	Tripped circuit breaker or blown fuse	Check circuit breaker inside the control panel. 24 VAC should be present at terminals 21 and 22.
Sensor Failure alarms	Blown fuse/Power failure	Check sensor cables and junction points for loose wire connection or loose wire nuts. Check DDC is powered.
Communication failure	Loose communications cable	Check communications cable connections
Bypass damper position doesn't change with firing rate	Actuator power failure/Loose wire connection	Check that firing rate display changes from 0 to 100 as the burner goes from low to high fire.
	Firing rate sensor power failure	Check that the 12 VDC power supply is on. A green LED should be lit to indicate power.

Table 4

### 6.2 DDC Module Replacement and Configuration

Should the DDC module need to be replaced, it will need to be configured with the correct P-Lan address to function properly. The default P-Lan address of the DDC module is 1 and the default Plan address of the HMI is 32. Refer to Appendix A for information regarding DDC/HMI P-Lan addressing.

1. Turn off power to the panel at the main circuit breaker.
2. Remove the terminals from the module to be replaced by pulling them out of their sockets.
3. Remove the module from the DIN rail by pulling the bottom tab down with a screwdriver. Pulling the tab should release the module from the DIN rail and allow it to be removed from the panel.
4. Install the new module on the DIN rail and connect the terminals.
5. Go to Appendix A for addressing instructions.

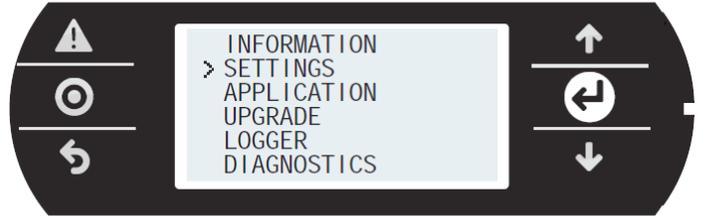
**APPENDIX A**

**DDC/HMI Addressing Steps**

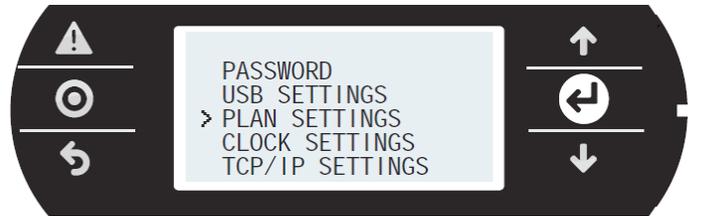
The controller pLAN is factory set as 1. The display is factory assigned as a private (Pr=private) or shared (Sh=shared) terminal with address 32. Addresses between 1 and 32 can be used to identify devices on the network, while address 0 identifies the DDC controller used for point-to point connection and to configure the controller.

Procedure:

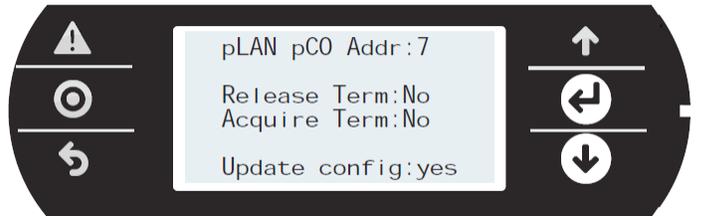
1. Press ALARM and ENTER together for 3 s. and enter the system menu. Select Settings.



2. Select pLAN Settings.



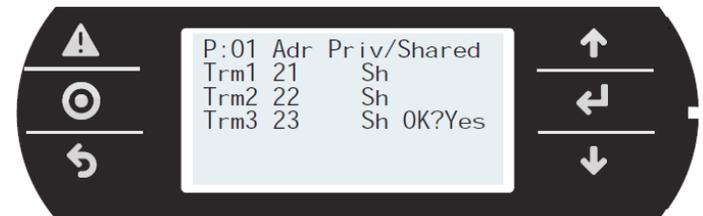
3. Set the pLAN address of the controller to 1 confirm by selecting "Update Configuration".



4. To configure the address of the terminal, press the UP, DOWN and ENTER together for 3 s. The screen at right is displayed, then set the address to 32 and confirm by pressing Enter.



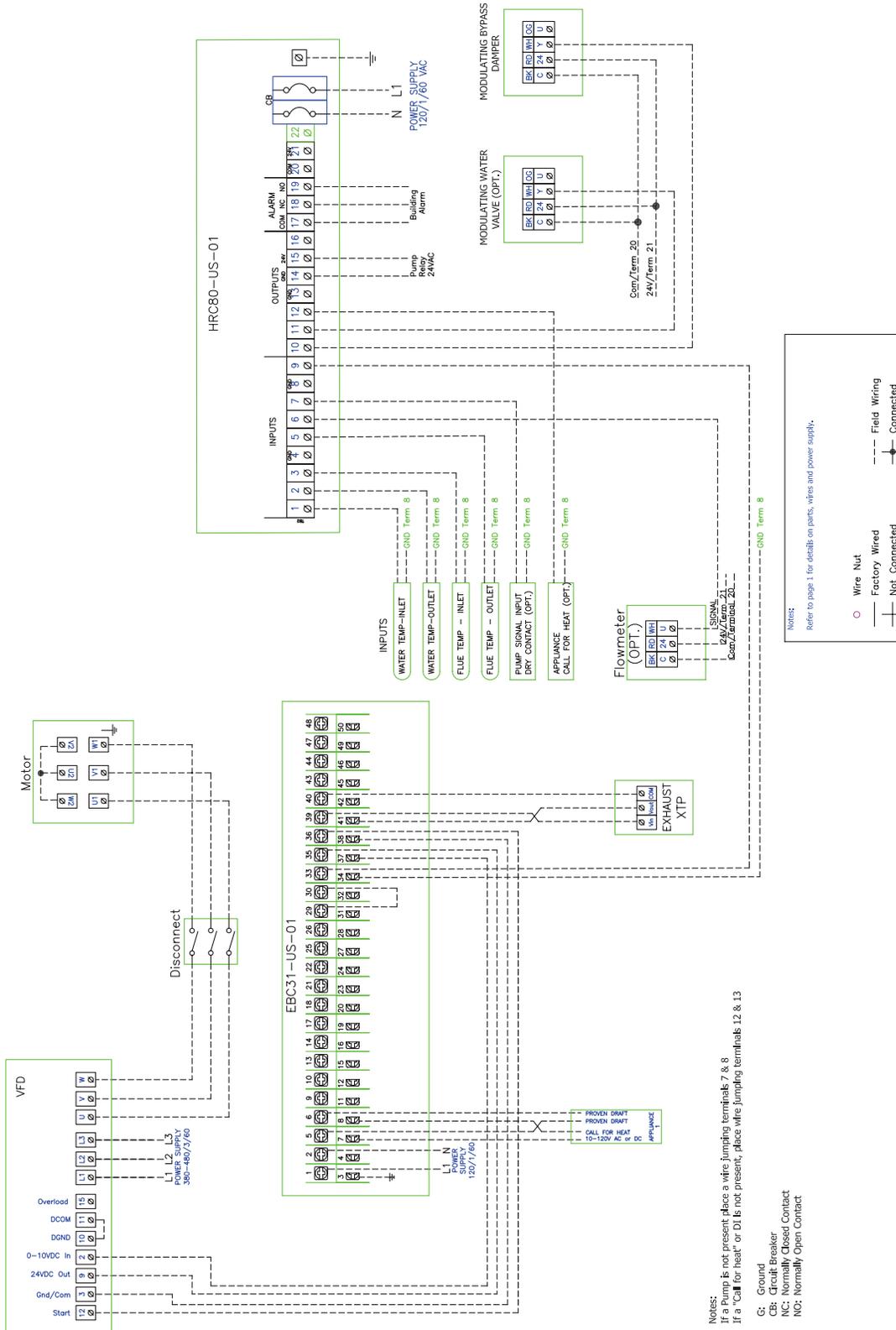
5. The screen at right will display, showing the list of the terminals configured. Set the terminals as private (Priv) and confirm to exit. After a few seconds, the connection will be established.



**APPENDIX B**

**System Wiring and Connection Diagrams**

FOR REFERENCE ONLY

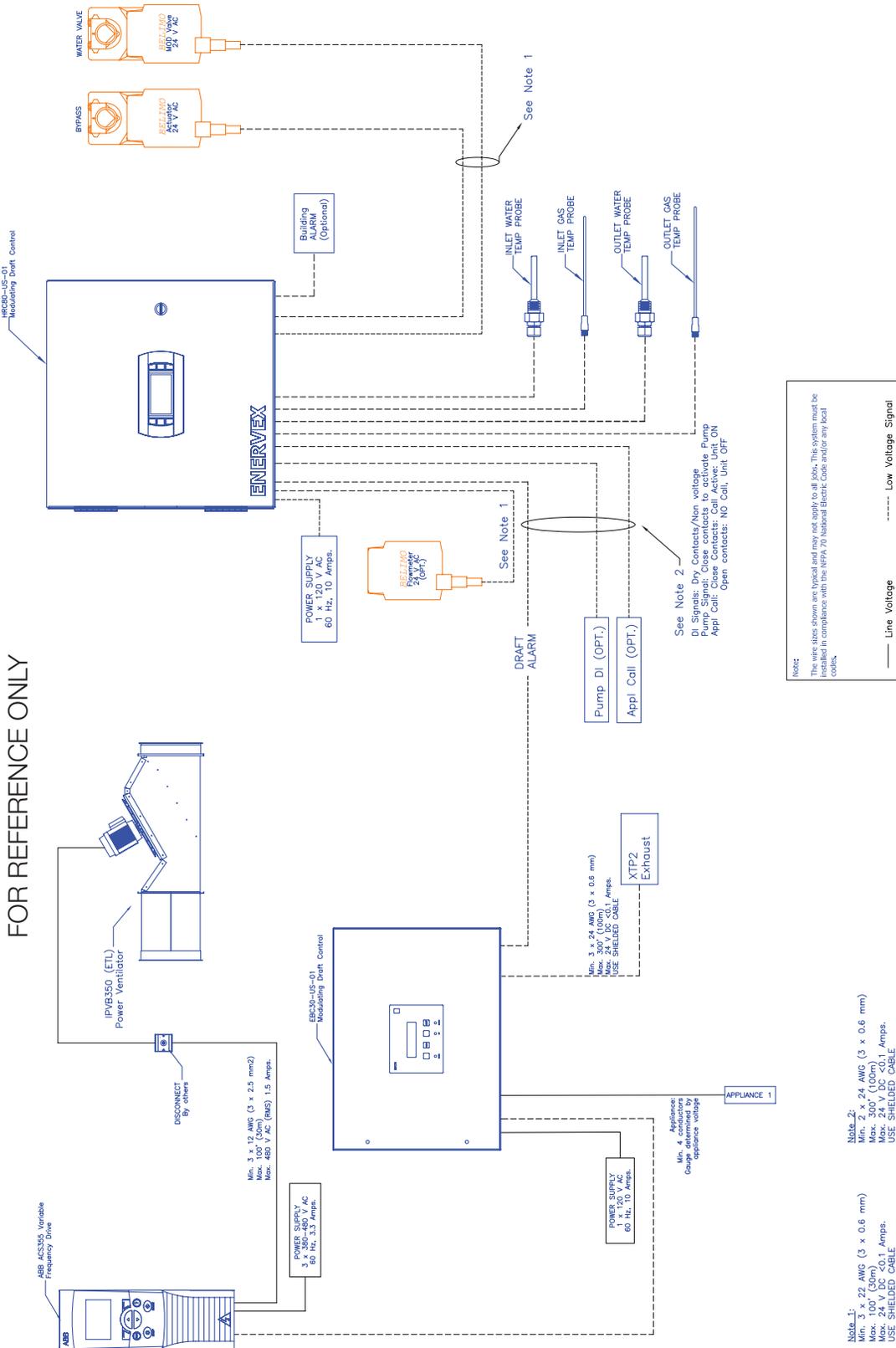


Notes:  
 If a Pump is not present, place a wire jumping terminals 7 & 8  
 If a "Call for Heat" or DI is not present, place wire jumping terminals 12 & 13  
 G: Ground  
 CB: Circuit Breaker  
 NC: Normally Closed Contact  
 NO: Normally Open Contact

Wiring Diagram of HRC80 with Bypass and Modulating Valve

**APPENDIX B**

**System Wiring and Connection Diagrams, cont.,**

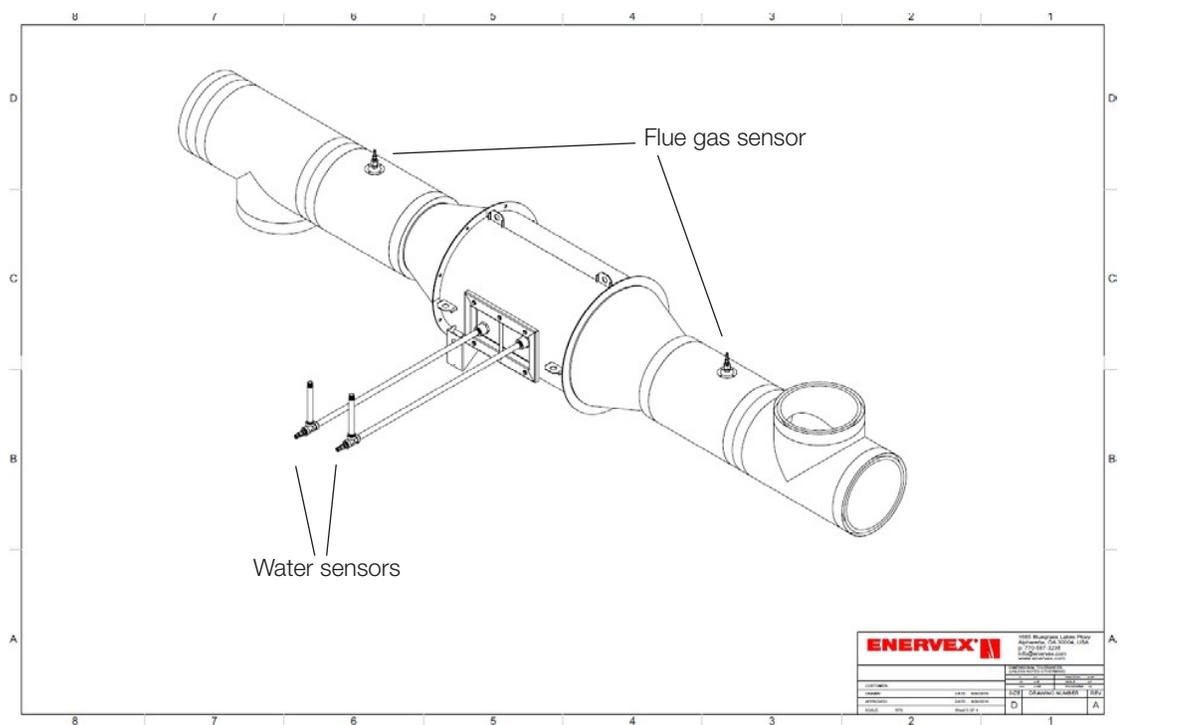
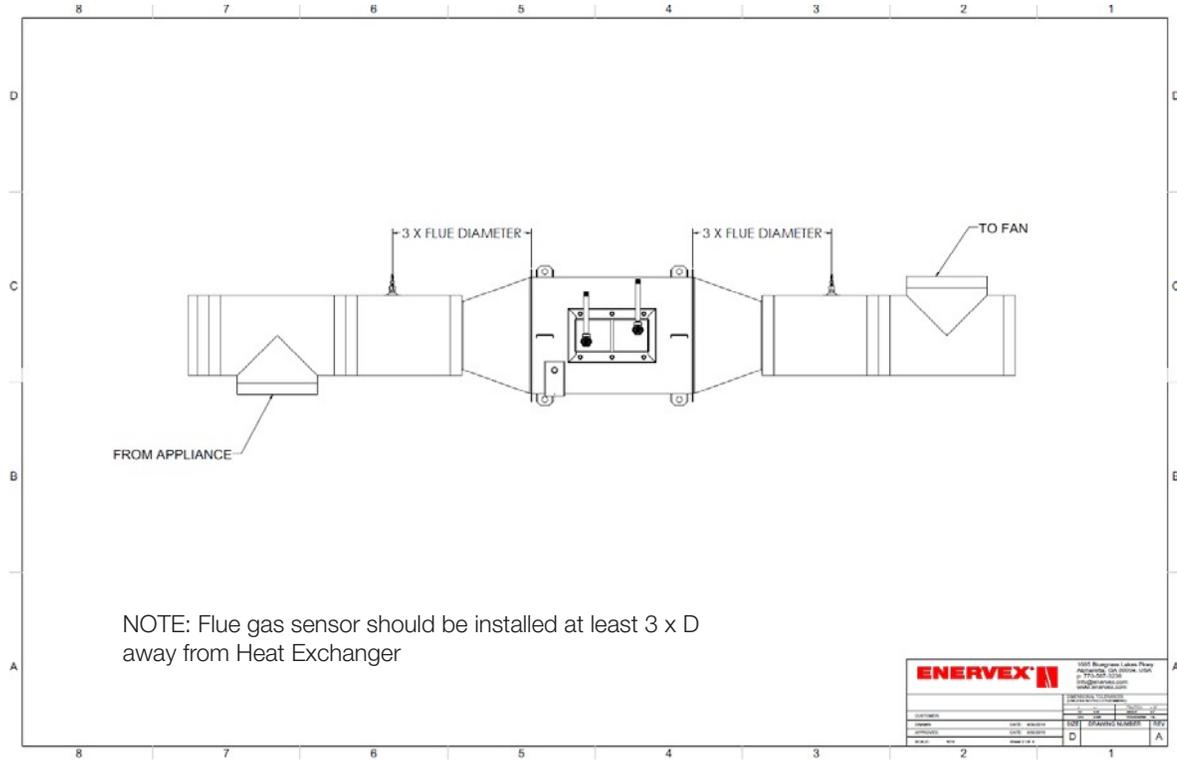


Connection Diagram with Bypass and Modulating Water Valve



## APPENDIX C

### System Water and Flue Gas Sensor Installation Diagrams, cont.,





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