4 APPENDICES

4.0 APPENDIX A: MODBUS CONFIGURATION

The NURO MODBUS® connection is available to interface with Building Management Systems. Harsco Industrial Patterson-Kelley offers an optional protocol converter that can translate the MODBUS® protocol into BACnet, LonWorks®, and Metasys® N2 protocols that are often used by Building Management Systems. One converter translates the protocol for multiple boilers. Depending on the secondary language determines how many boilers can communicate on one converter.

The NURO Modbus parameters are located in All Parameters>Boiler Parameters>General Boiler Settings. The two parameters are as follow: MODBUS BMS BAUD RATE and MODBUS BMS SLAVE ADDRESS (see page 28 for details).

⚠ CAUTION Only qualified control contractors should access the MODBUS® interface menu.

NOTE: When a reserved address is read, it will return an illegal address.

MODBUS® configuration parameters are listed below.

Protocol`	MODBUS® RTU
Supported MODBUS® commands	Read Holding registers (0x03) Write single Holding register (0x06)
Baud Rate	9600, 19200, 38400 bps
Data Length	8
Parity	None
Stop Bits	2
Physical Layer	RS 485 (two wire)

If multiple NUROs are on the Modbus network a delay of 20ms is required when switching between different slave addresses.

The table below lists the data available as a register map. All data is transmitted as unsigned integers. Decimal point locations are determined by dividing the integer by 10, 100, or 1000, etcetera as indicated. Temperatures are transmitted as °C.

Register addresses start at 0 (zero) based on the Modbus-IDA protocol specification. For the more traditional addressing scheme (starting at 40001) a value of 40001 should be added to the decimal address for each register.

MODBUS® REGISTER MAP

Register	Parameter	Read/Write	Type	Precision	Note
100	Outlet Temperature	R	Normal Temperature	0.1	Note 1
101	Inlet Temperature	R	Normal Temperature	0.1	Note 1
102	Stack Temperature	R	Normal Temperature	0.1	Note 1
103	DHW Temperature	R	Normal Temperature	0.1	Note 1
104	Header Temperature	R	Normal Temperature	0.1	Note 1
105	HX Temperature	R	Normal Temperature	0.1	Note 1
106	ODA Temperature Filtered	R	Normal Temperature	0.1	Note 1
107	Extra Field Temperature	R	Normal Temperature	0.1	Note 1
108	Wireless Temperature (ODA)	R	Normal Temperature	0.1	Note 1
109	Analog Input	R	4 -20 ma	0.1	Note 2
110	Analog Output	R	4 -20 ma	0.1	Note 2

Register	Parameter	Read/Write	Type	Precision	Note
111	Burner Control Digital I/O	R	Bit Map: 15 = Safety relay 14 = Night setback input 13 = Enable 12 = Undefined 11 = Undefined 10 = Limit control circuit 9 = Damper end switch input 8 = Interlock control circuit 7 = Alarm relay on 6 = Undefined 5 = Gas valve open 4 = External ignition on 3 = Relay D on 2 = Relay C on 1 = Relay B on 0 = Relay A on	0.1	Note 3
112	Burner Control Digital I/O 2	R	Bit Map: 15 - 8 = Reserved (always 0) 7 = Auxiliary input 2 6 = High gas pressure 5 = High temperature limit 4 = Low water cut-off 3 = Auxiliary input 1 2 = Start Interlock 2 1 = Start Interlock 1 0 = Air switch	0.1	Note 3
113	CH Mode Active Setpoint	R	Normal Temperature	0.1	Note 9
114	DHW Mode Active Setpoint	R	Normal Temperature	0.1	Note 9
130	Demand Source	R	Current Demand Source 0 = None 1 = CH 2 = DHW 3 = Freeze protection 4 = Manual 5 = CH & DHW 6 = DHW & CH		Note 4
131	Active Demand Status	R	Active Demand Status 0 = Normal 1 = System pump pre pump 2 = System pump post pump 3 = CH pump pre pump 4 = CH pump post pump 5 = Tank pump pre pump 6 = Tank pump post pump 7 = DHW pump pre pump 8 = DHW pump post pump 9 = Waiting anti cycle 10 = Mod back max temp 11 = Low fire hold 12 = Limit time to high fire 13 = Limit accelerate 14 = Limit decelerate 15 = Waiting for mode demand 16 = Waiting for boiler to start 17 = CH Pump running 18 = System pump running 19 = DHW pump running 20 = Tank pump running	0.1	

Register	Parameter	Read/Write	Type	Precision	Note
132	Boiler State	R	0 = Waiting for communication 1 = Standby 2 = Lockout 3 = Hold 4 = Waiting for air switch close 5 = Waiting for air switch open 6 = Opening damper 7 = Waiting for damper to open 8 = Pre purge 9 = Post purge 10 = Run 11 = Mod back delta temp 12 = Mod back max temp 13 = Mod back stack temp 14 = Pre-ignition 15 = Ignition 16 = Mod back delta temp exceeded 17 = Mod back max temp exceeded 18 = Mod back stack temp exceeded 19 = Rate modified by air switch 20 = Rate modified by outlet temperature 21 = Rate modified by delta limit 22 = Rate modified by stack limit 23 = Starting 24 = Fan only 25 = Stopping		
133	Flame Signal	R	0.01V – 50.00V	0.01	
134	Fan Speed	R	Fan speed type		
135	Firing Rate	R	0 – 200 = 0 – 100% firing rate	0.1	Note 5
136 – 137	Error Code	R	See error table		Note 6
138	Error Type		0 = No error 1 = Lockout 2 = Boiler hold 3 = Mode hold 4 = Alert caused alarm		
151 – 152	Burner Control Cycle Count	R	0 – 999,999	0.1	Note 6
153 – 154	Burner Control Run Hours	R	Hours	0.1	Note 6
171	CH boiler control				
172	BMS CH setpoint				
173	BMS CH demand				
191	DHW boiler control				
192	BMS DHW setpoint				
193	BMS DHW tank setpoint				

NOTE 1: Normal temperatures are in °C with 1 digit of precision. E.g. 155 °F = 68.3 °C = 683 output from Modbus

- **a. 32768 = Sensor Short**
- **b. 33024 = Sensor Open**
- **c. 33537 = Sensor Outside High Range**
- **d. 33792 = Sensor Outside low Range**
- **e. 34048 = Sensor Not Reliable**

NOTE 2: The milliamps are transmitted as: 4.0 ma = 40, 15.5 ma = 155, etc.

NOTE 3: The information is transmitted as a map of bits. The bit map is used to determine the state of the individual inputs and outputs. If an input or output is active then the corresponding bit in the 16 bit word will be 1. For example, for register 111 if relay B and relay C are both on and all others are off, our 16 bit word will be "0000000000000110". This equals 6 in decimal. So a 6 will be transmitted.

NOTE 4: The transmitted number corresponds to the current demand source of the boiler. Source 5 and 6 are used for simultaneous operation. The first demand indicates which demand is driving the firing rate.

NOTE 5: Firing rate is indicated as a number between 0 and 200 which corresponds to 0-100%. e.g. if the firing rate is 50%, the Modbus data will be 100. If the firing rate is 75%, the Modbus data will be 150.

NOTE 6: This number is transmitted as two 16 bit numbers across two registers to create one 32 bit number. To obtain the total value multiply the data from the first address by 65536 and then add the data from the second address to this number. For example, if the return from the first address is 5 and the return from the second address is 10516, then the total value for the requested data is 338196.

NOTE 7: The CH boiler control disables all CH modes if set to off. The BMS CH demand shuts down the CH demand if the CH demand source is set to Use BMS.

NOTE 8: This setpoint is changeable through the remote communication. If the control is set to use the BMS setpoint then this BMS setpoint is used.

NOTE 9: Normal Setpoint are in °C with 1 digit of precision. e.g. 155 °F = 68.3 °C = 683 output from Modbus. 33536 = Mode Not Active.