Electric Duct Heater

HECB Series

Modbus Communication Module User Guide

Contents

Introduction

The HECB Series Modbus Guide provides information for using Neptronic® communication feature. The communication feature uses Modbus communication protocol over serial line in the RTU mode and provides a Modbus network interface between client devices and Neptronic devices.

The HECB Series Modbus Guide assumes that you are familiar with Modbus terminology.

The following are the requirements for Modbus:

- *Data Model*. The Modbus server data model uses only the Holding Registers table.
- *Function Codes*. The Modbus server supports a limited function codes subset comprising:
    - Read Holding Registers (0x03)
    - Write Multiple Registers (0x10)
- *Exception Responses*. The Modbus server supports the following exception codes:
    - Illegal function
    - Illegal data address
    - Illegal data value
- *Serial Line*. The Modbus over serial line uses RTU transmission mode over a two-wire configuration RS485 (EIA/TIA-485 standard) physical layer.
    - The physical layer can use fixed baud rate selection or automatic baud rate detection (default) as per the **Network Auto Baud Rate** device menu item.
    - The supported baud rates are 9600, 19200, 38400, and 57600.
    - The physical layer also supports variable parity control and stop bit configuration.
    - Parity control can be activated through the **Network Parity** device menu item.
    - Stop bit configuration is modified through the **Network Stop Bits** menu item.
    - In auto baud rate configuration, if the device detects only consecutive bad frames (2 or more) for one second with any given baud rate, it will reinitialize itself to the next baud rate.
    - If the device does not detect any activity for one second or more, it will find a silent line to prevent a possible baud rate scan on the next frame it detects.
- *Addressing*. The device answers at the following two different addresses:
    - The device's unique address (1 to 246) that can be set through the device menu or through holding register index 0.
    - The permanent backdoor address for easy debugging. The backdoor for all devices is 247.

Holding Registers Table

Table Glossary

Name	Description	Name	Description
W	Writable Register	Bit Masks	For registers with multiple values using bit mask (example, flags)
RO	Read Only Register	MSB	Most Significant Byte
R/W	Read or Writable	LSB	Least Significant Byte
Unsigned	For range of values from 0 to 65,535, unless otherwise specified	MSW	Most Significant Word
Signed	For range of values from -32,768 to 32,767, unless otherwise specified	LSW	Least Significant Word

Holding Register Table

Register Index	Description	Data Type	Range	Writable
4000**0**	Identification, Address - Neptronic ID and Modbus address of current device.	Unsigned *Scale 100*	MSB = Product ID, LSB = Address Modbus Address (e.g. 110), LB = 1-247	RO
4000**1**	Analog control input (interpretation as per control mode).	Unsigned *Scale 100*	Unit: mV, Range: 0 to 10, 000. *Value/100 (e.g. 40 mV = 4000)*	RO
4000**2**	AI TPM duty in TPM control node	Bit String		RO
4000**3**	Pneumatic pressure measured from the signal on the analog input.	Unsigned *Scale 10*	Unit: PSI, Range:0 to 65,535. *Value/100 (e.g. 200 PSI = 2000)*	RO
4000**4**	DI TPM duty in TPM control node.	Bit String	Unit:, Range:	RO
4000**5**	Input temperature measured by thermistor on the analog input.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 5,000/3,200 to 12,200. *Value/100 (e.g.40°C = 4000/82°F = 8200)*	RO
4000**6**	Heater temperature sensor 1.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 10,500/3,200 to 22,100. *Value/100 (e.g.40°C = 4000/82°F = 8200)*	RO
4000**7**	Heater temperature sensor 2.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 10,500/3,200 to 22,100. *Value/100 (e.g.40°C = 4000/82°F = 8200)*	RO
4000**8**	Solid state relay temperature.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 10,500/3,200 to 22,100. *Value/100 (e.g.40°C = 4000/82°F = 8200)*	RO
4000**9**	Duct temperature discharge side.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 10,500/3,200 to 22,100. *Value/100 (e.g.40°C = 4000/82°F = 8200)*	RO
400**10**	Duct Temperature supply side.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 10,500/3,200 to 22,100. *Value/100 (e.g.40°C = 4000/82°F = 8200)*	RO

Register Index	Description	Data Type	Range	Writable
400**11**	On board setpoint read from the potentiometer.	Unsigned *Scale 100*	Unit: C°/F°, Range: 1,389 to 3,389/5,700 to 9,300. *Value/100 (e.g.15°C = 1500/60°F = 6000)*	RO
400**12**	Circuit board temperature.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 10,000/3,200 to 21,200. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	RO
400**13**	Temperature read on the TRL.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 5,000/3,200 to 12,200. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	RO
400**14**	Power phase 1 current measurement.	Unsigned *Scale 10*	Unit: A, Range: 0 to 700. *Value/10 (e.g.350A = 3500)*	RO
400**15**	Power phase 2 current measurement.	Unsigned *Scale 10*	Unit: A, Range: 0 to 700. *Value/10 (e.g.350A = 3500)*	RO
400**16**	Power phase 3 current measurement.	Unsigned *Scale 10*	Unit: A, Range: 0 to 700. *Value/10 (e.g.350A = 3500)*	RO
400**17**	Measure line frequency.	Unsigned	Unit: Hz, Range: 0 to 255.	RO
400**18**	System demand in all control modes.	Unsigned	Unit: %, Range: 0 to 1,000.	R/W
400**19**	Modulated stage duty cycle.	Unsigned	Unit: %, Range: 0 to 1,000.	RO
400**20**	Instant system output.	Unsigned	Unit: %, Range: 0 to 1,000.	RO
400**21**	Instant system power target.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550 = 35500)*	RO
400**22**	Instant system power measurement.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550 = 35500)*	RO
400**23**	Heater sensors' differential temperature.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 10,500/3,200 to 22,100. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	RO
400**24**	Duct sensors' differential temperature.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 10,500/3,200 to 22,100. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	RO
400**25**	kWh x 10 over the last energy audit period.	Unsigned *Scale 10*	Unit: kWh, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**26**	Proportional term temperature band (gain = 100%/band).	Unsigned *Scale 100*	Unit: C°/F°, Range: 5 to 255/9 to 459. *Value/100 (e.g.50°C = 5000/45°F = 4500)*	R/W
400**27**	Integral term integral time (gain = 1/time).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**28**	Differential term anticipation time (gain = time).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**29**	Unoccupancy setpoint.	Unsigned *Scale 100*	Unit: C°/F°, Range: 1,000 to 4,000/5,000 to 10,400. *Value/100 (e.g.35°C = 3500/65°F = 6500)*	R/W
400**30**	Vacant setpoint.	Unsigned *Scale 100*	Unit: C°/F°, Range: 1,000 to 4,000/5,000 to 10,400. *Value/100 (e.g.35°C = 3500/65°F = 6500)*	R/W
400**31**	Maximum system output as per user setting.	Unsigned	Unit: %, Range: 0 to 1,000.	R/W

Register Index	Description	Data Type	Range	Writable
400**32**	Heat output ramp integral time (gain = 1/time).	Unsigned	Unit: Seconds, Range: 0 to 720.	R/W
400**33**	Heater damping proportional band (gain = 100%/band).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**34**	Heater damping integral term integral time (gain = 1/time).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**35**	Heater damping differential term anticipation time (gain = time).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**36**	SSR damping proportional band (gain = 100%/band).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**37**	SSR damping Integral term integral time (gain = 1/time).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**38**	SSR damping Differential term anticipation time (gain = time).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**39**	Board damping proportional band (gain = 100%/band).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**40**	Board damping Integral term integral time (gain = 1/time).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**41**	Board damping Differential term anticipation time (gain = time).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**42**	Duct working temperature setpoint [6000 to 7500]°Cx100	Unsigned *Scale 100*	Unit: C°/F°, Range: 4,000 to 6,000. *Value/100 (e.g.50°C = 5000)*	R/W
400**43**	Duct cutout temperature setpoint.	Unsigned *Scale 100*	Unit: C°/F°, Range: 5,000 to 7,000. *Value/100 (e.g.50°C = 5000)*	R/W
400**44**	Duct damping proportional band (gain = 100%/band).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**45**	Duct damping integral term integral time (gain =1/time).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**46**	Duct damping differential term anticipation time (gain = time).	Unsigned	Unit: Seconds, Range: 0 to 255.	R/W
400**47**	Minimum demand before starting to heat.	Unsigned	Unit: %, Range: 0 to 100.	R/W
400**48**	Minimum demand difference with full capacity before forcing full capacity.	Unsigned	Unit: %, Range: 0 to 100.	R/W
400**49**	Minimum time of sufficient demand in seconds, before activating a new stage.	Unsigned	Unit: Seconds, Range: 1 to 255.	R/W
400**50**	Minimum time of insufficient demand in seconds, before deactivating a stage.	Unsigned	Unit: Seconds, Range: 1 to 255.	R/W
400**51**	Time pulse modulating stage power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**52**	Stage 1 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO

Register Index	Description	Data Type	Range	Writable
400**53**	Stage 2 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**54**	Stage 3 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**55**	Stage 4 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**56**	Stage 5 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**57**	Stage 6 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**58**	Stage 7 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**59**	Stage 8 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**60**	Stage 9 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**61**	Stage 10 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**62**	Stage 11 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**63**	Stage 12 power rating.	Unsigned *Scale 10*	Unit: kW, Range: 0 to 65,535. *Value/10 (e.g.3550kWh = 35500)*	RO
400**64**	Minimum time after fan activation in seconds, before heating and minimum time without heating in seconds, before fan deactivation.	Unsigned	Unit: Seconds, Range: 1 to 255.	R/W
400**65**	Minimum time after deactivating the fan in seconds, before activating it again.	Unsigned	Unit: Seconds, Range: 1 to 255.	R/W
400**66**	Fan power rating.	Unsigned *Scale 10*	Unit: hp, Range: 0 to 65,535. *Value/10 (e.g.3550hp = 35500)*	RO
400**67**	TRL user setpoint.	Unsigned *Scale 100*	Unit: C°/F°, Range: Setpoint min to Setpoint max *Value/100 (e.g.10°C = 1000 to 50°C = 5000/40°F = 4000 to 104°F = 10,400)*	R/W
400**68**	TRL minimum setpoint value.	Unsigned *Scale 100*	Unit: C°/F°, Range: 1,000 to Setpoint Max/5,000 to Setpoint Max *Value/100 (e.g.10°C = 1000 to 40°C = 4000/50°F = 5000 to 104°F = 10,400)*	R/W
400**69**	TRL maximum setpoint value.	Unsigned *Scale 100*	Unit: C°/F°, Range: Setpoint Min to 4,000/Setpoint Min to 10,400 *Value/100 (e.g.10°C = 1000 to 40°C = 4000/50°F = 5000 to 104°F = 10,400)*	R/W

Register Index	Description	Data Type	Range	Writable
400**70**	Temperature provided by a network service.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 5,000/3,200 to 12,200. *Value/100 (e.g.40°C = 4000/84°F = 8400)*	R/W
400**71**	Setpoint provided by a network service.	Unsigned *Scale 100*	Unit: C°/F°, Range: Setpoint min to Setpoint max *Value/100 (e.g.10°C = 1000 to 50°C = 5000/40°F = 4000 to 104°F = 10,400)*	R/W
400**72**	Maximum interval between 2 consecutive remote value updates (demand or temperature).	Unsigned	Unit: Minutes, Range: 1 to 15.	R/W
400**73**	Remaining seconds before remote timeout.	Unsigned	Unit: Seconds, Range: 900 to 0.	RO
400**74**	Duct supply changeover setpoint.	Unsigned *Scale 100*	Unit: C°/F°, Range: 0 to 10,500/3,200 to 22,100. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	R/W
400**75**	kWh consumption running average period.	Unsigned	Unit: Minutes, Range: 1 to 255.	R/W
400**76**	Input temperature sensor offset.	Signed *Scale 100*	Unit: C°/F°, Range: -1,000 to +1,000/-5,000 to +1,000. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	R/W
400**77**	Heater temperature sensor 1 offset.	Signed *Scale 100*	Unit: C°/F°, Range: -1,000 to +1,000/-5,000 to +1,000. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	R/W
400**78**	Heater temperature sensor 2 offset.	Signed *Scale 100*	Unit: C°/F°, Range: -1,000 to +1,000/-5,000 to +1,000. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	R/W
400**79**	Solid state relay temperature offset.	Signed *Scale 100*	Unit: C°/F°, Range: -1,000 to +1,000/-5,000 to +1,000. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	R/W
400**80**	Duct temperature discharge side offset.	Signed *Scale 100*	Unit: C°/F°, Range: -1,000 to +1,000/-5,000 to +1,000. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	R/W
400**81**	Duct Temperature supply side offset.	Signed *Scale 100*	Unit: C°/F°, Range: -1,000 to +1,000/-5,000 to +1,000. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	R/W
400**82**	Circuit board temperature offset.	Signed *Scale 100*	Unit: C°/F°, Range: -1,000 to +1,000/-5,000 to +1,000. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	R/W
400**83**	TRL sensor temperature offset.	Signed *Scale 100*	Unit: C°/F°, Range: -1,000 to +1,000/-5,000 to +1,000. *Value/100 (e.g.50°C = 5000/82°F = 8200)*	R/W
400**84**	Input States	Bit String	B0 = Thermal Cutout B1 = Air Flow Cutout B2 = Interlock Cutout	RO
400**85**	Output States	Bit String	B0 = FAN B1 = Stage 1 B2 = Stage 2 B3 = Stage 3 B4 = Stage 4 B5 = Stage 5 B6 = Stage 6	RO

Register Index	Description	Data Type	Range	Writable
			B7 = Stage 7 B8 = Stage 8 B9 = Stage 9 B10 = Stage 10 B11 = Stage 11 B12 = Stage 12	
400**86**	System Status	Bit String	B0 = Limited by heater box temperature B1 = Limited by SSR temperature B2 = Limited by board temperature B3 = Limited by duct temperature	RO
400**87**	System Options	Bit String	[B7, B12 – B14]: Reserved **B0: Network user temp units** *0 = Celsius; 1 = Fahrenheit* **B1 = Network control override** *0 = Deactivated; 1=Activated* **B2 = TRL user temperature units** *0 = Celsius; 1 = Fahrenheit* **B3 = TRL setpoint lock** *0 = Unlocked; 1=Locked* **B4 = TRL on/off lock** *0 = Unlocked; 1=Locked* **B5 = Changeover monitoring** *0 = Deactivated; 1=Activated* **B6 = Auto PID** *0 = Deactivated; 1=Activated* **B8 = Heater Safety** *0 = Deactivated; 1=Activated* (RO) **B9 = SSR Temp Safety** *0 = Deactivated; 1=Activated* (RO)	R/W

Register Index	Description	Data Type	Range	Writable
			B10 = Board Temp Safety *0 = Deactivated; 1=Activated (RO)* **B11 = Duct Temp Safety** *0 = Deactivated; 1=Activated (RO)* **B15 = System on/off** *0 = ON;1 = OFF*	
400**88**	System Alarms (1)	Bit String	[B13 - 15]: Reserved B0 = Thermal cutout open B1 = Air flow cutout open B2 = Interlock cutout open B3 = Heater high temperature cutout B4 = Board high temperature cutout B5 = SSR high temperature cutout B6 = Duct high temperature cutout B7 = Heater sensor 1 failure B8 = Heater sensor 2 failure B9 = Board sensor failure B10 = SSR sensor failure B11 = TRL communication timeout B12 = Remote management timeout	RO
400**89**	System Alarms (2)	Bit String	[B4 - B8]: Reserved B0 = External sensor failure B1 = Supply sensor failure B2 = Discharge sensor failure B3 = TRL sensor failure B9 = Current sensor 0 failure B10 = Current sensor 1 failure B11 = Current sensor 2 failure B12 = Measured power too high B13 = Measured power too low B14 = Air flow not detected (temperature differential) B15 = Heat not detected (temperature differential)	RO

Register Index	Description	Data Type	Range	Writable
400**90**	Control Mode	Bit String	0 = Control_Mode_External 1 = Control_Mode_Internal 2 = Control_Mode_Neptronic_Signal 3 = Control_Mode_Remote 4 = Control_Mode_Pneumatic 5 = Control_Mode_TPM 6 = Control_Mode_Res1 7 = Control_Mode_Res2	RO
400**91**	Air Flow Status	Bit String	0 = No Heat 1 = No Flow 2 = Low Flow 3 = Regular Flow	RO
400**92**	Temperature Source	Bit String	0 = External 1 = Internal 2 = TRL 3 = Supply 4 = Discharge	R/W
400**93**	Setpoint Source	Bit String	0 = Onboard Potentiometer 1 = Remote 2 = TRL	R/W
400**94**	Occupancy	Bit String	0 = Occupied 1 = Unoccupied 2 = Vacant	-
400**95**	Number of ON/OFF stages	Bit String	Unit: Stages	RO

Notes

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