

MODBUS RTU ADDENDUM FOR HiQDTmA Loop Powered pH Sensors

HiQDTmA pH SENSOR PROCESS VALUES

Access to **READ** core process values is gained through MODBUS function code (04) READ INPUT REGISTERS. Six (6) values are available when requesting process values. Values can be called starting at any index and any number of values can be requested so long as it does not exceed the total number available from the starting index of the call. Values are sent in succession from the starting index of the call. If only one value is requested, then just the starting index is sent. Missing registers such as 30005 and 30006 will return a value of "0" when called.

#	Name	Range	Engineered Values	Register
1	Measurement pH	0..18,000	-2.000 to +16.000	30001
2	Measurement °C	0..3,400	-40.0 to +300.0 °C	30002
3	Measurement raw mV for pH	5,000..45,000 *	-1,000.0 to +1,000.0	30003
4	Measurement raw °C	0..3,400	-40.0 to +300.0 °C	30004
7	Hold Output Status	0,1	0 = Not on Hold (Live), 1 = Output on Hold	30007
8	mA Output	0..2,000	0.00 to 20.00	30008

* When raw mV is below engineered value limit, then this is indicated by the integer 4,999 being sent for this index.

* When raw mV is above engineered value limit, then this is indicated by the integer 45,001 being sent for this index.

USER HiQDTmA pH CALIBRATION/ANALYTIC PARAMETERS & REGISTERS

Access to **READ** only MODBUS READ HOLDING REGISTERS is gained through function code (03). Access for all **WRITE** type parameters is gained through MODBUS function code (16) preset multiple registers. Values can be written starting at any index and any number of values can be written so long as it does not exceed the total number of parameters that are available from the starting index of the call.

#	Name	Range	Engineered Units & Values	Register
1	Offset for pH measurement (A.P.)	0..5,000	0 = -250.0mV & 5,000 = +250.0mV	40001
2	Slope low acid pH measurement	600..1,800	600 = 30.0mV & 1,800 = 90.0mV	40002
3	Slope high base pH measurement	600..1,800	600 = 30.0mV & 1,800 = 90.0mV	40003
4	Offset oC measurement	0..500	0 = -25.0 °C & 500 = +25.0 °C	40004
5	Step change on handheld communicator & Windows manual Calibrations	0..5	0=0.05, 1=0.10, 2=0.20, 3=0.50, 4=1.0, 5=2.0 Units are mV per button	40005
6	Temp Comp Coefficient for pH sensors	0..999	µV per °C	40006
7	Dampener	0..9	0=1, 1=2, 2=3, 3=4, 4=5, 5=8, 6=10, 7=15, 8=20, 9=30 Units are Seconds	40007
8	Output delay	0..9	0=1, 1=2, 2=3, 3=4, 4=5, 5=8, 6=10, 7=15, 8=20, 9=30 Units are Seconds	40008
9	Modbus baudrate	0..1	0 = 9,600 kbps & 1 = 19,200 kbps	40009
10	Reference auto calibration pH offset	0..1,800	0 = -2.00 pH & 1,800 = +16.00 pH	40010
11	Reference auto calibration slope low	0..900	0 = -2.00 pH & 900 = +7.00 pH	40011
12	Reference auto calibration slope high	900..1,800	900 = +7.00 pH & 1,800 = +16.00 pH	40012
13	Reference auto calibration oC offset Manual TC mode if registers 3,401-6,801	0..3,400 3,401..6,801	0 = -40.0 °C and 3,400 = +300.0 °C 3,401 = -40.0 °C and 6,801 = +300.0 °C	40013
14	Hours since mV offset adjustment	0..65,535	Units are Hours (Max 2,730 days)	40014
15	Hours since low acid slope	0..65,535	Units are Hours (Max 2,730 days)	40015
16	Hours since high alkaline (base) slope	0..65,535	Units are Hours (Max 2,730 days)	40016
17	Hours since oC offset adjustment	0..65,535	Units are Hours (Max 2,730 days)	40017

SYSTEM HiQDTmA pH PARAMETERS - THESE ARE READ-ONLY VALUES

Access to user parameters & statistics and system parameters is gained through MODBUS READ HOLDING REGISTERS function code (03). Values can be called starting at any index and any valid number of values can be requested. Values are sent in succession from the starting index of the call. If only one value is requested, then just the starting index is sent.

#	Name	Range	Engineered Units & Values	Register
1	ASTI: manufacture date (Year)	00..99	00 = 2000 and 99 = 2099	40021
2	ASTI: manufacture date (Month)	01..12	1 = January....12 = December	40022
3	ASTI: manufacture date (Date)	01..31	Day of Month	40023
4	Serial Number (year)	00..99	00 = 2000 and 99 = 2099	40024
5	Serial Number (month)	01..12	1 = January....12 = December	40025
6	Serial Number (letter)	0..246	See Appendix 3 for Details	40026
7	Serial Number (#)	00..255	Unique Identifier in Alpha Block	40027
8	Item Number	0..65,535	Unique Identifier for Sensor Configuration & Options	40028
9	Sensor: Min temperature in use	0..3,400	0 = -40.0 °C and 3,400= +300.0 °C	40029
10	Sensor: Max temperature in use	0..3,400	0 = -40.0 °C and 3,400= +300.0 °C	40030
11	Sensor: Total days in use	0..65,535	Units are Hours (Max 2,730 days)	40031

FACTORY HiQDTmA pH PARAMETERS - THESE ARE READ-ONLY VALUES

Access to factory accessible only parameters is gained through MODBUS READ HOLDING REGISTERS function code (03). Values can be called starting at any index and any valid number of values can be requested. Values are sent in succession from the starting index of the call. If only one value is requested, then just the starting index is sent.

#	Name	Range	Engineered Units & Values	Register
1	Sensor Type	1	1 = pH	40036
2	SW revision	0..255	Check factory for most current rev #	40037
10	mV Offset Precalibration	0..5,000	0 = -250.0mV and 5,000 = +250.0mV	40045
11	Acid Slope Precalibration	600..1,800	600 = 30.0mV and 1,800 = 90.0mV	40046
12	Base Slope Precalibration	600..1,800	600 = 30.0mV and 1,800 = 90.0mV	40047
13	Temperature Offset Precalibration	0..500	0 = -25.0 °C and 500= +25.0 °C	40048

NOTE FOR REGISTERS 40045 to 40048:

When a reset back to factory default calibrations call is performed the values in these registers are the basis for the reset.

MODBUS SLAVE REGISTERS AVAILABLE ONLY ON HiQDTmA SENSORS

Access to **READ** only MODBUS READ HOLDING REGISTERS is gained through function code (03). Access for all **WRITE** type parameters is gained through MODBUS function code (16) preset multiple registers. Values can be written starting at any index and any number of values can be written so long as it does not exceed total number of parameters available from starting index of call. Missing registers such as 40402, 40406-40409 will return value of "0" when called.

Name	Range	Engineered Values	Register
Analog Output Hold Feature	0,1 **	0="Off", 1="On"	40401
Toggle non-inverted or inverted output	0,1	0= non.inv, 1=inverted	40403
Low 0/4mA Setpoint for Analog Output	0..9,444	0.00% to 94.44%	40404
High 20mA Setpoint for Analog Output	556..10,000	5.56% to 100.00%	40405
4mA Trim Offset User Calibration	0..2,000 ***	-10.00% to 10.00%	40410
20mA Trim Span User Calibration	0..2,000 ***	-10.00% to 10.00%	40411
Temperature at sensor board	0..1,700	-40.0 to +130.0 °C	40412

** Register 40401 will always be set to "0" boot time meaning that analog output hold is off and live current loop output. This register can be modified while in operation but any change in state to "Off" will be lost upon power down since this register value is only stored in RAM. Register 30007 is the read only copy of register 40401. All registers except 40401 & 30007 are stored in non-volatile EEPROM and are retained after power cycling. Correction to mA output is performed while modbus communications occur based on value of register 40401: If value is 0 or 1 correction expects HHC to be present and if value is 2 or 3 correction expects FTDI type USB to RS485 converter to be present (with Windows software).

*** For best precision 4mA trim offset and 20mA trim span calibrations should be performed with sensor at the typical process temperature.

EXAMPLE SCALING FOR 4-20mA ANALOG OUTPUT OF HiDTmA pH SENSORS

% Unit for Scaling	Engineered pH Units
0.00%	-2.00
5.56%	-1.00
11.11%	0.00
16.67%	1.00
22.22%	2.00
27.78%	3.00
33.33%	4.00
38.89%	5.00
44.44%	6.00
50.00%	7.00
55.56%	8.00
61.11%	9.00
66.67%	10.00
72.22%	11.00
77.78%	12.00
83.33%	13.00
88.89%	14.00
94.44%	15.00
100.00%	16.00

SCALING NOTE:

Minimum difference between low & high setpoint must be 1.00 pH. This equates to a difference between low & high setpoint of 5.56% to fulfill this engineered unit requirement in scaling units.

FOR FURTHER DETAILS ON PROGRAMMING WITH THESE HiQDTmA SENSORS PLEASE REFER TO THE SEPARATE HiQDT MODBUS RTU PROGRAMMING GUIDE. WHILE SPECIFIC INFORMATION ABOUT EACH REGISTER IN THE HiQDTmA pH SENSOR CAN BE FOUND IN THIS DOCUMENT THE BASICS ABOUT INTERFACING THESE SMART SENSORS ARE FOUND IN MAIN HiQDT MODBUS RTU PROGRAMMING GUIDE.

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