PPC4000
Modbus Communications

DESCRIPTION

The protocol to be used is Modbus RTU. This is implemented by the master (PC, PCL, etc.) issuing a poll to the slave (PPC-4000) and the slave responding with the appropriate message. Note: This bulletin is only relevant for PPC-4000s which display engineering code EC08, or later for which ModBus communications are enabled.

A typical format of a poll request is as follows:

DST	FNC	ADR HI	ADR LO	DAT HI	DAT LO	CRC LO	CRC HI

DST refers to the logical address of the slave.

FNC is the function being requested. FNC 03 is a read request. FNC 06 is a write request.

ADR is the address of the register (or starting address of the registers) being read or the address of the register being written to.

The PPC-4000 Modbus map is divided into two sections. In the first "Read-Only Section", all registers are mapped as HOLDING REGISTERS, FNC 03. In the second "Low-Level User Command and Config", registers are read/write, with read being accomplished with FNC 03, and write being accomplished with FNC 06. Register addresses begin at 40001 but is interpreted as address 00.

DAT is the number of words being requested where a word is an integer consisting of 2 bytes, OR is the word value to be written to the register pointed to by ADR.\

The normal response from a slave, in the case of FNC 03 read, is as follows:

DST	FNC	DBC	DATA.... Hi/Lo	CRC LO	CRC HI

DBC is the data byte count being returned. It must be two times the DAT number from the poll request.

DATA is the data returned and is always a series of 2 byte integers. If 4 words were requested then DBC would be 8 and there would be 8 data bytes or 4 data words containing the requested data.

The normal response from a slave, in the case of FNC 06, is as follows:

DST	FNC	ADR HI	ADR LO	DAT HI	DAT LO	CRC LO	CRC HI

In this case, DAT represents the data written to the register at ADR.

The data communications (baud) rate is menu selectable at the PPC-4000 from 4800 to 57,600 bits per second, with 8 bits per byte, no parity, and 1 stop bit.

Below is a table of currently available messages provided by the PPC-4000 followed by a description, where necessary.

Read-Only Section				
Holding Register	Message Address	Word Requested	Response	Value
40001	00	1	Operational State	Current operational state of the PPC 4000 (0-16)
40003	02	2	System On Minutes	Upper 16 bits of the 32 bit System Operational Minute Counter
40004	03		" "	Lower 16 bits of the 32 bit System Operational Minute Counter
40005	04	2	Burner on minutes	Upper 16 bits of the 32 bit Burner Running Minute Counter
40006	05		" "	Lower 16 bits of the 32 bit Burner Running Minute Counter
40007	06	2	Completed Burner Cycles	Upper 16 bits of the 32 bit Burner Cycle Counter
40008	07		" "	Lower 16 bits of the 32 bit Burner Cycle Counter
40009	08	1	Current Modulation Rate	0-100%
40010	09	1	Modulation Mode	Modulation Mode (0 = manual, 1 = auto)
40011	10	1	Current internal temperature of the PPC 4000	value = degree C or F (units)
40012	11	1	Current Profile Commission Point	At what profile point is the control currently running, (P0-P23)
40013	12	1	Current Calculated CO_2 value	
40014	13	1	PPC 4000 Model	0 = PPC-4000 only 1 = PPC-4000 plus internal Flame Safeguard Control
40015	14	1	Current Selected Profile	1 through 4
40016	15	1	Total # of commissioned points in current profile	0 - 24
40017	16	1	Current Profile Commissioned Points Range	
40018	17	1	Current Digital Input values	Present state for Digital Input 1 to Digital Input 10 (1-16 for FSG ver)
40022	21	2	Current VFD 1 position in 1/10th degree	actual position (0-1000)
40023	22		Commanded VFD 1 position in 1/10th degree	commanded position (0-1000)
40024	23	2	Current VFD 2 position in 1/10th degree	actual position (0-1000)
40025	24		Commanded VFD 2 position in 1/10th degree	commanded position (0-1000)
40026	25	1	Current running efficiency	(0-100%)
40027	26	1	Current O2 Target Value in 1/10th %	
40036	35	4	O2 Probe Status (see O2 Probe Manual)	

Holding Register	Message Address	Word Requested	Response	Value
40037	36		O2 Probe Stack Temperature (see O2 Probe Manual)	
40038	37		O2 Probe Ambient Temperature (see O2 Probe Manual)	
40039	38		O2 Probe O2 Level (see O2 Probe Manual)	
40052	51	1	Calibration constant	A number of "counts" ranging from 819 to 860. Used to normalize raw sensor readings
40060	59	1	Sensor 1 measured raw value	Raw A/D measurement of the Primary sensor
40061	60	1	Sensor 2 measured raw value	Raw A/D measurement of the Aux 1 sensor
40062	61	1	Sensor 3 measured raw value	Raw A/D measurement of the Aux 2 sensor
40066	65	1	Sensor 4 measured raw value	Raw A/D measurement of sensor 4 (Note 1)
40067	66	1	Sensor 5 measured raw value	Raw A/D measurement of sensor 5 (Note 1)
40080	79	1	Servo 1 current position	
40089	88	1	Servo 2 current position	
40098	97	1	Servo 3 current position	
40107	106	1	Servo 4 current position	
40116	115	1	Servo 5 current position	
40125	124	1	Servo 6 current position	
40134	133	1	Servo 7 current position	
40143	142	1	Servo 8 current position	
40152	151	1	Servo 9 current position	
40161	160	1	Servo 10 current position	
40191	190	62	Lockout History	Lower 8 bits is the number of the next lockout error count
40192	191		Lockout History - Current active error number	0 if no active error, error number otherwise (see separate publication on PPC-4000 Error Codes)
40193	192		Lockout History - Total number of errors detected	Stored Lockout Count
40194	193		Lockout History - Fault 1	Most Recent Fault. Upper 8 bits = Profile Position, lower 8 bits = Operational state when error occurred
40195	194		Lockout History - Fault 1 - Error code	
40196	195		Lockout History - Fault 1 - Time of Fault Occurrence	Upper Byte = Minutes, Lower Byte = Seconds
40197	196		Lockout History - Fault 1 - Date of Fault Occurrence	Upper Byte = Day of the Month, Lower Byte = Hour
40198	197		Lockout History - Fault 1 - Date of Fault Occurrence	Upper Byte = Weekday (0=Sunday), Lower Byte = Month
40199	198		Lockout History - Fault 1 - Year of Fault Occurrence	

Holding Register	Message Address	Word Requested	Response	Value
40200	199		Lockout History - Fault 2	2nd Most Recent Fault. Upper 8 bits = Profile Position, lower 8 bits = Operational state when error occurred
40201	200		Lockout History - Fault 2 - Error code	
40202	201		Lockout History - Fault 2 - Time of Fault Occurrence	Upper Byte = Minutes, Lower Byte = Seconds
40203	202		Lockout History - Fault 2 - Date of Fault Occurrence	Upper Byte = Day of the Month, Lower Byte = Hour
40204	203		Lockout History - Fault 2 - Date of Fault Occurrence	Upper Byte = Weekday (0=Sunday), Lower Byte = Month
40205	204		Lockout History - Fault 2 - Year of Fault Occurrence	
40206	205		Lockout History - Fault 3	3rd Most Recent Fault. Upper 8 bits = Profile Position, lower 8 bits = Operational state when error occurred
40207	206		Lockout History - Fault 3 - Error code	
40208	207		Lockout History - Fault 3 - Time of Fault Occurrence	Upper Byte = Minutes, Lower Byte = Seconds
40209	208		Lockout History - Fault 3 - Date of Fault Occurrence	Upper Byte = Day of the Month, Lower Byte = Hour
40210	209		Lockout History - Fault 3 - Date of Fault Occurrence	Upper Byte = Weekday (0=Sunday), Lower Byte = Month
40211	210		Lockout History - Fault 3 - Year of Fault Occurrence	
40212	211		Lockout History - Fault 4	4th Most Recent Fault. Upper 8 bits = Profile Position, lower 8 bits = Operational state when error occurred
40213	212		Lockout History - Fault 4 - Error code	
40214	213		Lockout History - Fault 4 - Time of Fault Occurrence	Upper Byte = Minutes, Lower Byte = Seconds
40215	214		Lockout History - Fault 4 - Date of Fault Occurrence	Upper Byte = Day of the Month, Lower Byte = Hour
40216	215		Lockout History - Fault 4 - Date of Fault Occurrence	Upper Byte = Weekday (0=Sunday), Lower Byte = Month
40217	216		Lockout History - Fault 4 - Year of Fault Occurrence	
40218	217		Lockout History - Fault 5	5th Most Recent Fault. Upper 8 bits = Profile Position, lower 8 bits = Operational state when error occurred
40219	218		Lockout History - Fault 5 - Error code	
40220	219		Lockout History - Fault 5 - Time of Fault Occurrence	Upper Byte = Minutes, Lower Byte = Seconds
40221	220		Lockout History - Fault 5 - Date of Fault Occurrence	Upper Byte = Day of the Month, Lower Byte = Hour
40222	221		Lockout History - Fault 5 - Date of Fault Occurrence	Upper Byte = Weekday (0=Sunday), Lower Byte = Month
40223	222		Lockout History - Fault 5 - Year of Fault Occurrence	

Holding Register	Message Address	Word Requested	Response	Value
40224	223		Lockout History - Fault 6	6th Most Recent Fault. Upper 8 bits = Profile Position, lower 8 bits = Operational state when error occurred
40225	224		Lockout History - Fault 6 - Error code	
40226	225		Lockout History - Fault 6 - Time of Fault Occurrence	Upper Byte = Minutes, Lower Byte = Seconds
40227	226		Lockout History - Fault 6 - Date of Fault Occurrence	Upper Byte = Day of the Month, Lower Byte = Hour
40228	227		Lockout History - Fault 6 - Date of Fault Occurrence	Upper Byte = Weekday (0=Sunday), Lower Byte = Month
40229	228		Lockout History - Fault 6 - Year of Fault Occurrence	
40230	229		Lockout History - Fault 7	7th Most Recent Fault. Upper 8 bits = Profile Position, lower 8 bits = Operational state when error occurred
40231	230		Lockout History - Fault 7 - Error code	
40232	231		Lockout History - Fault 7 - Time of Fault Occurrence	Upper Byte = Minutes, Lower Byte = Seconds
40233	232		Lockout History - Fault 7 - Date of Fault Occurrence	Upper Byte = Day of the Month, Lower Byte = Hour
40234	233		Lockout History - Fault 7 - Date of Fault Occurrence	Upper Byte = Weekday (0=Sunday), Lower Byte = Month
40235	234		Lockout History - Fault 7 - Year of Fault Occurrence	
40236	235		Lockout History - Fault 8	8th Most Recent Fault. Upper 8 bits = Profile Position, lower 8 bits = Operational state when error occurred
40237	236		Lockout History - Fault 8 - Error code	
40238	237		Lockout History - Fault 8 - Time of Fault Occurrence	Upper Byte = Minutes, Lower Byte = Seconds
40239	238		Lockout History - Fault 8 - Date of Fault Occurrence	Upper Byte = Day of the Month, Lower Byte = Hour
40240	239		Lockout History - Fault 8 - Date of Fault Occurrence	Upper Byte = Weekday (0=Sunday), Lower Byte = Month
40241	240		Lockout History - Fault 8 - Year of Fault Occurrence	
40242	241		Lockout History - Fault 9	9th Most Recent Fault. Upper 8 bits = Profile Position, lower 8 bits = Operational state when error occurred
40243	242		Lockout History - Fault 9 - Error code	
40244	243		Lockout History - Fault 9 - Time of Fault Occurrence	Upper Byte = Minutes, Lower Byte = Seconds
40245	244		Lockout History - Fault 9 - Date of Fault Occurrence	Upper Byte = Day of the Month, Lower Byte = Hour
40246	245		Lockout History - Fault 9 - Date of Fault Occurrence	Upper Byte = Weekday (0=Sunday), Lower Byte = Month
40247	246		Lockout History - Fault 9 - Year of Fault Occurrence	

Holding Register	Message Address	Word Requested	Response	Value
40248	247		Lockout History - Fault 10	10th Most Recent Fault. Upper 8 bits = Profile Position, lower 8 bits = Operational state when error occurred
40249	248		Lockout History - Fault 10 - Error code	
40250	249		Lockout History - Fault 10 - Time of Fault Occurrence	Upper Byte = Minutes, Lower Byte = Seconds
40251	250		Lockout History - Fault 10 - Date of Fault Occurrence	Upper Byte = Day of the Month, Lower Byte = Hour
40252	251		Lockout History - Fault 10 - Date of Fault Occurrence	Upper Byte = Weekday (0=Sunday), Lower Byte = Month
40253	252		Lockout History - Fault 10 - Year of Fault Occurrence	
40265	264	1	Sensor 1 set point value	
40266	265	1	Sensor 1 Cut In value	
40267	266	1	Sensor 1 Cut Out value	
40269	268	1	Sensor 1 Margin Alarm value	
40270	269	1	Sensor 1 Limit Alarm value	
40273	272	1	Sensor 2 set point value	
40274	273	1	Sensor 2 Cut In value	
40275	274	1	Sensor 2 Cut Out value	
40277	276	1	Sensor 2 Margin Alarm value	
40278	277	1	Sensor 2 Limit Alarm value	
40281	280	1	Sensor 3 set point value	
40282	281	1	Sensor 3 Cut In value	
40283	282	1	Sensor 3 Cut Out value	
40285	284	1	Sensor 3 Margin Alarm value	
40286	285	1	Sensor 3 Limit Alarm value	
40289	288	1	Sensor 4 set point value	
40290	289	1	Sensor 4 Cut In value	
40291	290	1	Sensor 4 Cut Out value	
40293	292	1	Sensor 4 Margin Alarm value	
40294	293	1	Sensor 4 Limit Alarm value	
40297	296	1	Sensor 5 set point value	
40298	297	1	Sensor 5 Cut In value	
40299	298	1	Sensor 5 Cut Out value	
40301	300	1	Sensor 5 Margin Alarm value	

Holding Register	Message Address	Word Requested	Response	Value
40302	301	1	Sensor 5 Limit Alarm value	
40347	346	10	PCV Setpoint string	20 character string
40357	356	10	PCV measured value string	20 character string
Lower Level User Command and Config				
41002	1001	1	Burner Control On/Off	True,False (1,0). Setting this to 1 turns the burner on.
41003	1002	1	Burner Control Low Fire	True,False (1,0). Setting this to a 1 sets the PPC 4000 to Low Fire.
41004	1003	1	Burner Control Lead Lag	True,False (1,0). Setting this to a 1 makes the PPC 4000 into a sequence master (When sequencing is enabled).
41005	1004	1	Burner Control Auto Manual	True,False (1,0). Setting this to a 1 sets the PPC 4000 to Auto Modulation Control.
41018	1017	1	Manual Modulation Rate	Value of the manual modulation rate (has no effect until the PPC 4000 is in Manual Modulation Mode).

Interpreting Input Sensor "Raw" Values

The calibration constant is factory set to achieve the proper reading at 4mA and 20 mA. It is based on the actual hardware in the product and the A/D reference voltage in the micro controller at the time of manufacture. It has a range of 819 to 860 counts and is accessible from register 51 (40052). This should be the first value read in and used for all pressure and temperature calculations.

The calibration constant is used to convert the actual "raw" sensor reading to meaningful pressure or temperature values. The pressure sensors are all 0 psig at the 4 mA and below reading. For the two temperature sensors, 32-350 and 32-752, the maximum range of each is 318 and 720 degrees respectively.

If the calibration constant represents 20 mA input then 1/5 of that represents 4 mA input or 0.2 times the calibration constant.

To convert a pressure or temperature "raw" reading to actual units, use the following:

((["Raw" Reading /calibration constant] - 0.2) / 0.8) * Sensor Range) + Sensor Offset where Reading is the value returned from modbus register 40060, 40061 or 40062.

SENSOR TYPE	SENSOR RANGE	SENSOR OFFSET
TS350-2, -4, -8	318	32
TS752-2, -4, -8	720	32
BLPS-15	15	0
BLPS-25	39.7	-14.7
BLPS-30	30	0
BLPS-200	200	0
BLPS-300	300	0

Note 1: Sensors 4 or 5 do not reference this calibration constant and thus only raw signal values are applicable.

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WARRANTIES

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