ModBus communication protocol of PBL series brushless DC motor driver

1 Overview

Communication transmission is divided into independent information header, and sent coded data. The following communication transmission method definition is also MODBUS RTU communication protocol is compatible:

Baud rate	115200
Start bit	1 person
Data bit	8-bit
Parity bit	1 bit (even parity bit)
Stop bit	1 person
Error check	CRC (Redundant Cyclic Code)

Each character or byte is sent in this order (from left to right): Least Significant Bit (LSB)... Most Significant Bit

(MSB)

Start	1	2	3	4	5	6	7	8	check	stop

RTU mode bit sequence

Initial structure = ≥ 4 bytes of time
Address code = 1 byte
Function code = 1 byte
Data area = N bytes
Error check = 16-bit CRC code
End structure = ≥ 4 bytes of time

Frame description:

Start	Slave address	function code	data	CRC	End
>4 character idle time	1 byte	1 byte	1-123 bytes	2 bytes	>4 characters idle time

RTU message frame

Address code: The address code is the first byte of communication transmission. This byte indicates that the slave with the address code set by the user will Receive information sent by the host. And each slave has a unique address code, and the response is sent back with The respective address code starts. The address code sent by the master indicates the address of the slave to be sent, and the address sent by the slave The code indicates the address of the returned slave. Note: Address 0 is the broadcast address, which is the address of the communication command sent by the host When it is 0, all slaves will receive and respond.
Function code: The second byte of communication transmission. ModBus communication protocol defines the function number as 1 to 127. driver Only use part of the function codes. The drive as a slave responds to the host request, the function code sent by the The function code sent by the master is the same, and indicates that the slave has responded to the operation of the master. If the function code sent by the slave

The highest bit of is 1 (for example, the function code is large and 127 at the same time), which indicates that the slave does not respond to the operation or sends an error.
Data area: The data area is different according to different function codes. The data area can be actual value, set point, main The address sent from the machine to the slave or from the machine to the master.

CRC code: Two-byte error detection code.

2 Function code description

The drive currently only supports some ModBus function codes:

function code	Description
03H	Read parameters, single or multiple parameters can be read
06H	Modify a single parameter
10H	Modify multiple parameters

2.1 Read parameter 03H

Description

Read parameters, single or multiple parameters can be read

Example

The slave address is 11H. The start address of the parameter is 006BH, and the end address is 006DH. Total visits for this query

Ask multiple parameters.

Communication content sent by the host:

	HEX hexadecimal number
Slave address	11
function code	03
Parameter address high byte	00
Parameter address low byte	6B
Number of parameters high byte	00
Low byte of parameter number	03
CRC high byte	76
CRC low byte	87

The content of the communication reply from the machine:

The length of the parameter is 2 bytes. For a single parameter, the high byte of the parameter is transmitted first, and the low byte

The data is then transferred. Among the parameters, the low address parameters are transmitted first, and the high address parameters are transmitted later.

Slave response

	HEX hexadecimal number
Slave address	11
function code	03
Number of bytes	6
Data 1 high byte (006BH)	00
Data 1 low byte (006BH)	6B
Data 2 high byte (006CH)	00
Data 2 low byte (006CH)	13
Data 3 high byte (006DH)	00
Data 3 low byte (006DH)	00
CRC high byte	38
CRC low byte	B9

Parameters 006BH to 006DH result

006BH High byte	006BH Low byte	006CH High byte	006CH Low byte	006DH High byte	006DH Low byte
00	6B	00	13	00	00

2.2 Modify parameter 06H

Description

Write parameters. Note that the 06H instruction can only operate parameters, and 10H can set single or multiple parameters.

Example

The slave address is 11H. The parameter address is 0001H. The parameter content is 0003H.

	HEX hexadecimal number
Slave address	11
function code	06
Register address high byte	00
Register address low byte	01
Data 1 high byte	00
Data 1 low byte	01
CRC check high byte	9A
CRC check low byte	9B

Slave response

	HEX hexadecimal number
Slave address	11
function code	06
Register address high byte	00
Register address low byte	01
Number of registers high byte	00
Low byte of register number	01
CRC check high byte	1B
CRC check low byte	5A

2.3 Modify parameter 10H

Description

Modify multiple parameters

Example

The slave address is 11H. The start address of the parameter is 0001H, and the end address of the parameter is 0002H. Total visits

2

Parameters. The content of parameter 0001H is 000AH, and the content of parameter 0002H is 0102H.

	HEX hexadecimal number
Slave address	11
function code	10
Register start address high byte	00
Register start address low byte	01
Number of registers high byte	00
Low byte of register number	02
Number of bytes	04

Data 1 high byte	00
Data 1 low byte	0A
Data 2 high byte	01
Data 2 low byte	02
CRC check high byte	C6
CRC check low byte	F0

Slave response

	HEX hexadecimal number
Slave address	11
function code	10

Register start address high byte	00
Register start address low byte	01
Number of registers high byte	00
Low byte of register number	02
CRC check high byte	12
CRC check low byte	98

3 parameter list

address	Description
	Control instruction low word
	BIT0: 0 stop 1 start
0	BIT1: 0 forward and 1 reverse
1	Control instruction high word
	Motor status low word
	BIT0:0 Standby 1 movement
2	BIT1: 0 forward and 1 reverse
3	Motor status high word
4	Alarm status low word
5	Alarm status high word
6	HALL status
7	Motor position
8	Motor speed
9	Motor current
10	U phase current
11	V phase current
12	W phase current
13	bus voltage
14	Digital input
15	Digital input
16	Digital output
17	Digital output
18	Analog input
19	Analog input
20	Analog input
twenty one	Analog input
twenty two	Keep
twenty three	Keep
twenty four	Keep
25	Keep
26	Keep

27	Keep
28	Keep
29	Keep
30	Keep
31	Keep
32	Keep
33	Keep
34	Keep
35	Keep
36	Keep
37	Keep
38	Keep
39	Keep
40	Keep
41	Keep
42	Keep
43	Keep
44	Keep
45	Keep
46	Keep
47	Keep
48	Keep
49	Keep
50	Actual motor speed (RPM)
51	Bus voltage (V Volt)
52	Analog speed input (mV millivolt)
53	Motor current (A ampere)
54	Motor power (W Watt)
55	U phase current: AD value-motor current offset value (p2[44])
56	V phase current: AD value-motor current offset value (p2[44])
57	W phase current: value calculated by UV
58	Motor duty cycle
59	Speed loop output value
60	HALL sensor and bridge arm status, display mode: the displayed value will be hexadecimal value, convert Binary value
61	AD channel 0 (original AD value of analog input)
62	AD channel 1 (original AD value of V phase current)
63	AD channel 2 (original AD value of W phase current)
64	AD channel 3 (original AD value of bus voltage)
65	Show planning speed
66	PWM output limit value (PWM timer count value)
67	Display the calculated motor current for overload protection
68	Display current loop output value

69	Display speed loop integral
70	Motor current AD value
71	Display the maximum duty cycle of PWM input 1000
72	Analog speed input (mV millivolt)
73	Motor current (A ampere)
74	Motor power (W Watt)
75	U phase current: AD value-motor current offset value (p2[44])
76	V phase current: AD value-motor current offset value (p2[44])
77	W phase current: value calculated by UV

78	Motor duty cycle
79	Speed loop output value
	HALL sensor and bridge arm status, display mode: the displayed value will be hexadecimal value, convert
80	Binary value
81	AD channel 0 (original AD value of analog input)
82	AD channel 1 (original AD value of V phase current)
83	AD channel 2 (original AD value of W phase current)
84	AD channel 3 (original AD value of bus voltage)
85	Show planning speed
86	PWM output limit value (PWM timer count value)
87	Display the calculated motor current for overload protection
88	Display current loop output value
89	Display speed loop integral
	HALL sensor and bridge arm status, display mode: the displayed value will be hexadecimal value, convert
90	Binary value
91	AD channel 0 (original AD value of analog input)
92	AD channel 1 (original AD value of V phase current)
93	AD channel 2 (original AD value of W phase current)
94	AD channel 3 (original AD value of bus voltage)
95	Show planning speed
96	PWM output limit value (PWM timer count value)
97	Display the calculated motor current for overload protection
98	Display current loop output value
99	Display speed loop integral
	Control mode (0)
100	0: Speed closed loop mode 1: Duty cycle mode 2: Torque mode
	Whether to use current loop
101	0: not used 1: used
102	Minimum pulse width
103	Dead time
104	Update rate
105	Number of motor pole pairs
106	Acceleration
107	decrease speed

108	V phase current offset
109	W phase current offset
110	Precharge time (milliseconds) (invalid)
111	Maximum temperature (invalid)
	HALL commutation angle
112	0:120 degrees, 1:60 degrees
	PWM signal frequency
113	0:8K 1:12K 2:16K 3:20K
	Deceleration mode
114	0: Natural deceleration (slow deceleration) 1: Braking deceleration (fast deceleration)
	Drive motor waveform
115	0: SINE shape 1: trapezoid
	Movement direction
116	0: Forward 1: Reverse
	Whether to use encoder
117	0: not used 1: used
	Whether to use the brake function
118	0: not used 1: used
	Whether to use DC brake
119	0: not used 1: used
	Is there a speed sensor (Hall)
120	0: No 1: Yes
	Speed sensor type (linear or switch type)
121	0: switch type 1: linear

122	Encoder line number
123	Minimum speed
124	Maximum speed
125	Minimum bus voltage
126	Maximum bus voltage
127	Brake start bus voltage
128	Brake off bus voltage
129	Bus voltage protection value during deceleration (if exceeding, the deceleration speed will be reduced)
130	Speed loop proportional gain, which is equivalent to P1.7, has priority over P1.7.
131	The speed loop integral gain is equivalent to P1.8 and has priority over P1.8.
132	Speed loop differential gain
133	Maximum braking duration (ms)
134	Brake cooling time (ms)
135	Accelerating current
136	Communication timeout (invalid)
137	Version number (invalid)
138	Rated bus voltage calculation ratio
	Whether to use overcurrent protection
139	0: not used 1: used

140	Rated current
	The overload rate (maximum allowable torque) set to 200 means the allowable maximum current
	200% of the rated current of the motor (P2.40), the actual current exceeds the rated current, or
	If the actual power exceeds the rated power, the protection action will be triggered after a period of accumulation.
141	The current is forced to decrease until it reaches the percentage set by parameter P2.42.
	The motor allows the current during continuous operation. When the power overload occurs, the electric
	Flow until the set percentage of this parameter, this parameter can be less than 100%, because
	When some motors are in the high-speed section, even the rated current will cause power overload.
142	Setting the parameter to less than 100 can avoid this problem.
	Overload time Overload calculation time period, the accumulated time length is in milliseconds, which is
143	Protection is invalid at 0
144	Motor current offset (reserved)
145	Overcurrent protection (reserved)
	Bus voltage protection
146	(0) invalid (1) valid
	MCU overheat protection
147	(0) invalid (1) valid
	HALL fault protection
148	(0) invalid (1) valid
	Motor stall protection
149	(0) invalid (1) valid
	Maximum positive and negative current limit protection
150	(0) invalid (1) valid
	Overload protection (invalid)
151	0: No detection 1: Only alarm and current reduction without shutdown 2: Alarm and shutdown
	Overheating protection
152	(0) invalid (1) valid
153	Current loop proportional gain
154	Current loop integral gain
155	Test parameters (reserved)
	The original speed loop output limit value, which can limit the current effect, this value *4096/65535
156	It is the motor current AD reading; the maximum 65535 is the motor current 4096
	Current loop current limit, the value is the motor current AD reading, the measured current exceeds this value
157	The duty cycle is not increased, only decreased
	Power overload protection:
158	(0) invalid (1) valid
159	Speed loop integral limit (0--65535)
160	Current loop integral limit (0--65535)
	Speed loop integration period: how many cycles of the speed loop PI (speed loop period 1ms) to integrate

161	Once, 0 is integrated every period (0-999)
162	Current loop integration period: how many cycles of the current loop PI (current loop period is the 4th parameter PWM period interval) integrate once, 0 means to integrate every period (0-999)
163	Whether to use the speed loop PI parameter changes with the current planning speed

	KP planning speed coefficient: current KP = set KP * current acceleration / KP plus
164	Speed coefficient + KP acceleration offset
	KP planning speed offset: current KP = set KP * current acceleration / KP plus
165	Speed coefficient + KP acceleration offset
166	Average current ratio during bus current sampling
167	(Reserved)
168	(Reserved)
169	Minimum output value of speed loop in acceleration section and uniform speed section (reserved)
170	Starting speed
171	Motor PWM duty cycle limit, 65535 is 100%
172	Maximum negative current
173	Maximum positive current
174	Speed loop PI calculation offset
175	Current loop PI calculation offset
176	Low speed detection filter time ms
177	Low speed deceleration value RPM
178	Current loop output minimum PWM duty cycle
	PWM duty cycle limit value increment speed, unit: (100/65535)/ms, 65535
179	100% when
	Whether the feedback current is reversed
180	0: No reverse 1: Reverse
181	Speed loop change rate limit
182	Current loop rate of change limit
183	Current loop output offset
184	Reserved parameters
185	Back EMF coefficient
186	rated power
187	Display ratio of average current
188	Bus voltage calculation offset
	When the motor is stopped, whether the duty cycle is 0 as the basis for judging that the motor has stopped
	(0) invalid (1) valid
	This function is used in some special occasions: when the motor stops, it will be dragged and run by the load.
	As a result, the zero speed is usually regarded as the failure of the stop judgment, which leads to the problem of unable to stop. Set to
189	1 It is not limited by the actual speed and can stop normally.
	Current sampling method:
190	(0) Bus current sampling (1) Phase current sampling
	When the speed loop output value is 0, when the duty cycle is less than the setting value of P2.92, the
	Is the flow loop output zero
191	(0) Not allowed (1) Allowed
	When P2.91=1, the duty cycle is less than this value, and when the speed loop output is 0, the
	The output of the flow loop is reduced to 0:
192	(0) Not allowed (1) Allowed
193	Calculate the maximum acceleration

194	Bus voltage filtering time constant, the unit is the number of cycles of motor PWM.

195	Effective level setting in PWM speed control mode (0) Valid at low level (1) Valid at high level
196	Current sampling method: (0) Bus current sampling (1) Phase current sampling
197	When the speed loop output value is 0, when the duty cycle is less than the setting value of P2.92, the Is the flow loop output zero (0) Not allowed (1) Allowed
198	When P2.91=1, the duty cycle is less than this value, and when the speed loop output is 0, the The output of the flow loop is reduced to 0: (0) Not allowed (1) Allowed
199	Calculate the maximum acceleration
200	Display content selection
201	Internal speed
202	Speed command source
203	Direction setting 0: Normal mode 1: Reverse direction
204	Select the start and stop signal source 0: Key control (ENT key controls start and stop, UP and DOWN keys control speed increase Minus, RETURN key reverses the direction of motor movement) 1: External IO control 2: Communication command control
205	Number of motor pole pairs
206	The original P2 parameter group switch is now invalid
207	Speed proportional gain
208	Speed integral gain
209	Acceleration setting, default 1000RPM/S
210	Deceleration setting, default 1000RPM/S
211	Maximum speed of analog input, in RPM
212	Analog input zero offset (millivolt<3300, default 100)
213	In the internal speed mode, use the button to change the speed equivalent (press the button once to increase or decrease the speed)
214	Restore the system default parameters and set it to 1511, which will take effect after power off.
215	Drive address 1-255 Address 0 is the broadcast address
216	Starting speed at start Whether to HOLD the motor when the motor is stopped 0: No HOLD 1: 3 lower bridge arms open
217	2: 1 upper bridge arm and 2 lower bridge arms fixed duty cycle
218	HOLD duty cycle 0-65553
219	Display speed filter coefficient
220	The current display ratio is affected by this parameter when P1.0=3.
221	Maximum calculated voltage of user analog voltage input (mV<3300)
222	The minimum calculated voltage of user analog voltage input (mV<3300)