ZLAC8015 SERVO DRIVER (SPECIAL FOR HUB SERVO MOTOR)

RS485 COMMUNICATION INSTRUCTION

Version	Description	Date
V1.0	-	2020-03-14
V1.01	-	2020-04-14
V1.02	1. Add address 2000h, 2003h, 2004h; 2. Modify routine of function data 0x03.	2020-06-12
V1.03	1. Modify routine of function data 0x03.	2020-06-16
V1.04	1. Update the format of the protocol format. 2. Modify the description of address 0x2032. 3. Add emergency stop command /clear fault command.	2020-07-28
V1.05	1. Modify Profile Position Mode routine of Chapter 3.2 and Chapter 3.3. 2. Add address 0x202B.	2021-5-21
V1.07	1. Add 485 status word 2. Add alarm PWM processing method 3. Add overload processing method	2022-7-15

CATALOG

1. RS485 SERIAL PORT SETTINGS..... 3
2. PROTOCOL FORMAT..... 3
2.1 Read Register Function Code 0x03..... 3
2.2 Write Single Register (16-bit data) Function Code 0x06..... 4
2.3 Write Multiple Register Function Code 0x10 4
3. CONTROL ROUTINE..... 5
3.1 Profile Velocity Mode 5
3.2 Profile Position Mode (Relative Position) 6
3.3 Profile Position Mode (Absolute Position)..... 6
3.4 Profile Torque Mode..... 6
4. ADDRESS DIRECTIONARY..... 6

1. RS485 SERIAL PORT SETTINGS

RS485 communication of ZLAC8015 supports Modbus RTU protocol.

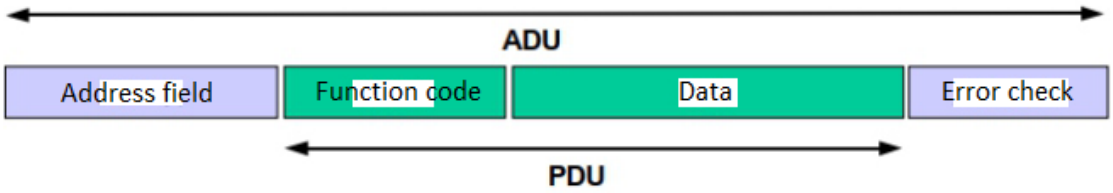
The driver address can be set to 0-127. The address 1-3 could be set by DIP switch. When the DIP switch is set to 0, the address could be set through software, its range is 4-127, the default address is 4.

For RS485 communication, ZLAC8015 has 7 optional baud rates: 9600, 19200, 38400, 57600, 115200, 128000, 256000. Baud rate could be set through software, its default value is 115200.

There are 8 data bits, without parity check. There is 1 stop bit.

2. PROTOCOL FORMAT

The MODBUS protocol defines a protocol data unit (PDU), which has nothing to do with the basic communication layer. The MODBUS protocol mapping of specific bus or network, can introduce some add-on domain on the application data unit (ADU).



The MODBUS protocol defines three PDUs:

MODBUS requests PDU = {function code + request data field}

MODBUS responses PDU = {function code + response data field}

MODBUS abnormal responses PDU = {abnormal function code + error code}

The function codes supported by ZLAC8015 are as below:

Function description	Function code	Error function code
Read multiple registers	0x03	0x83
Write single register	0x06	0x86
Writer multiple registers	0x10	0x90

Error function code shows as below:

Error code	Name	Meaning
0x01	Illegal function code	Function error
0x02	Illegal data address	Data address error
0x03	Illegal data value	Data error

2.1 Read Register Function Code 0x03

Eg: Send command “Read the actual speed of motor”, return “The actual speed of motor is 10RPM”

Send:

Command	Content Description
01	Driver Address
03	Function Code
20	High 8 bits of register start address
2C	Low 8 bits of register start address
00	High 8 bits of register number
01	Low 8 bits of register number
4E	High 8 bits of CRC check
03	Low 8 bits of CRC check

Return data:

Command	Content Description
01	Driver Address
03	Function Code
02	Number of bytes read
00	High 8 bits of data
64	Low 8 bits of data
B9	High 8 bits of CRC check
AF	Low 8 bits of CRC check

2.2 Write Single Register (16-bit data) Function Code 0x06

Eg: Write target speed 100RPM

Send:

Command	Content Description
01	Driver Address
06	Function Code
20	High 8 bits of register start address
3A	Low 8 bits of register start address
00	High 8 bits of register number
64	Low 8 bits of register number
A3	High 8 bits of CRC check
EC	Low 8 bits of CRC check

Return data:

Command	Content Description
01	Driver Address
06	Function Code
20	High 8 bits of register start address
3A	Low 8 bits of register start address
00	High 8 bits of register number
64	Low 8 bits of register number
A3	High 8 bits of CRC check
EC	Low 8 bits of CRC check

2.3 Write Multiple Register Function Code 0x10

Eg: Write encoder wire No. 1024, motor pole pairs 15 pairs

Send:

Command	Content Description
04	Driver Address
10	Function Code
20	High 8 bits of register start address
0B	Low 8 bits of register start address
00	High 8 bits of register number
02	Low 8 bits of register number
04	Number of bytes
04	High 8 bits of data 0
00	Low 8 bits of data 0
00	High 8 bits of data 1
0F	Low 8 bits of data 1
6A	High 8 bits of CRC check
E9	Low 8 bits of CRC check

Return data:

Command	Content Description
01	Driver Address
10	Function Code
20	High 8 bits of register start address
0B	Low 8 bits of register start address
02	Number of registers
3B	High 8 bits of CRC check
CA	Low 8 bits of CRC check

3. CONTROL ROUTINE

3.1 Profile Velocity Mode

Description	Send	Return
Set Profile Velocity Mode	01 06 20 32 00 03 63 C4	01 06 20 32 00 03 63 C4
Set S-type acceleration time 500ms	01 06 20 37 01 F4 33 D3	01 06 20 37 01 F4 33 D3
Set S-type deceleration time 500ms	01 06 20 38 01 F4 03 D0	01 06 20 38 01 F4 03 D0
Motor enable	01 06 20 31 00 08 D2 03	01 06 20 31 00 08 D2 03
Set target speed 100RPM	01 06 20 3A 00 64 A3 EC	01 06 20 3A 00 64 A3 EC
Set target speed -100RPM	01 06 20 3A FF 9C E3 9E	01 06 20 3A FF 9C E3 9E
Interrupt motor enable	01 06 20 31 00 07 92 07	01 06 20 31 00 07 92 07

Note: The target speed should be sent after the mode is set.

3.2 Profile Position Mode (Relative Position)

Description	Send	Return
Set relative Profile Position Mode	01 06 20 32 00 01 E2 05	01 06 20 32 00 01 E2 05
Set maxspeed of 50RPM	01 06 20 36 00 32 E3 D1	01 06 20 36 00 32 E3 D1
Set S-type acceleration time 200ms	01 06 20 37 00 C8 32 52	01 06 20 37 00 C8 32 52
Set S-type deceleration time 200ms	01 06 20 38 00 C8 02 51	01 06 20 38 00 C8 02 51
Motor enable	01 06 20 31 00 08 D2 03	01 06 20 31 00 08 D2 03
Set target position 20480 pulses	01 10 20 34 00 02 04 00 00 50 00 54 89	01 10 20 34 00 02 0B C6
Start up	01 06 20 31 00 10 D2 09	01 06 20 31 00 10 D2 09
Set target position -20480 pulses	01 10 20 34 00 02 04 FF FF B0 00 1D 6D	01 10 20 34 00 02 0B C6
Start up	01 06 20 31 00 10 D2 09	01 06 20 31 00 10 D2 09
Interrupt motor enable	01 06 20 31 00 07 92 07	01 06 20 31 00 07 92 07

Note: The target position should be sent after the mode is set.

3.3 Profile Position Mode (Absolute Position)

Description	Send	Return
Set absolute Profile Position Mode	01 06 20 32 00 02 A2 04	01 06 20 32 00 02 A2 04
Set maxspeed of 150RPM	01 06 20 36 00 96 E2 6A	01 06 20 36 00 96 E2 6A
Set S-type acceleration time 100ms	01 06 20 37 00 64 32 2F	01 06 20 37 00 64 32 2F
Set S-type deceleration time 100ms	01 06 20 38 00 64 02 2C	01 06 20 38 00 64 02 2C
Motor enable	01 06 20 31 00 08 D2 03	01 06 20 31 00 08 D2 03
Set target position 20480 pulses	01 10 20 34 00 02 04 00 00 50 00 54 89	01 10 20 34 00 02 0B C6
Start up	01 06 20 31 00 10 D2 09	01 06 20 31 00 10 D2 09
Set target position -20480 pulses	01 10 20 34 00 02 04 FF FF B0 00 1D 6D	01 10 20 34 00 02 0B C6
Start up	01 06 20 31 00 10 D2 09	01 06 20 31 00 10 D2 09
Interrupt motor enable	01 06 20 31 00 07 92 07	01 06 20 31 00 07 92 07

Note: The target position should be sent after the mode is set.

3.4 Profile Torque Mode

Description	Send	Return
Set Profile Torque Mode	01 06 20 32 00 04 63 C4	01 06 20 32 00 04 63 C4
Set torque slope 500	01 06 20 3B 01 F4 F3 D0	01 06 20 3B 01 F4 F3 D0
Motor enable	01 06 20 31 00 08 D2 03	01 06 20 31 00 08 D2 03
Set target torque 2000mA	01 06 20 33 07 D0 71 A9	01 06 20 33 07 D0 71 A9
Set target torque-2000mA	01 06 20 33 F8 30 31 D1	01 06 20 33 F8 30 31 D1
Interrupt motor enable	01 06 20 31 00 07 92 07	01 06 20 31 00 07 92 07

Note: The target torque should be sent after the mode is set.

3.5 Profile emergency command

Emergency command

Description	Send	Receive
Emergency stop	01 06 20 31 00 05 13 C6	01 06 20 31 00 05 13 C6

Release emergency command in velocity mode.

Description	Send	Receive
Enable	01 06 20 31 00 08 D2 03	01 06 20 31 00 08 D2 03
Target speed 100RPM	01 06 20 3A 00 64 A3 EC	01 06 20 3A 00 64 A3 EC

Release emergency command in position mode.

Description	Send	Receive
Target position 20480	01 10 20 34 00 02 04 00 00 50 00 54 89	01 10 20 34 00 02 04 00 00 50 00 54 89
Enable	01 06 20 31 00 08 D2 03	01 06 20 31 00 08 D2 03
Start up	01 06 20 31 00 10 D2 09	01 06 20 31 00 10 D2 09

Release emergency command in torque mode.

Description	Send	Receive
Target torque 2000mA	01 06 20 33 07 D0 71 A9	01 06 20 33 07 D0 71 A9
Enable	01 06 20 31 00 08 D2 03	01 06 20 31 00 08 D2 03

3.6. Clear the fault

Description	Send	Receive
Clear the fault	01 06 20 31 00 06 53 C7	01 06 20 31 00 06 53 C7

4. ADDRESS DIRECTIONARY

Index	Name	Description	Type	Property	Default
2000h	Communication offline time	Driver and host communication offline time setting. Unit: ms Range: 0-32767;	U16	RW/S	1000
2003h	Input signal status	2 input signal level status Bit0-Bit1: X0-X1 input level status	U16	RO	0
2004h	Out signal status	2 output signal level status Bit0-Bit1: Y0-Y1 output status;	U16	RO	0
2005h	Reset feedback position	Used to dear feedback position in Profile Position Mode. 0: invalid; 1: Clear the feedback position; Not saved.	U16	RW	0
2006h	In absolute Profile Position Mode, dear the current position	Used to dear the current position in absolute Profile Position Mode. 0: invalid. 1: The current position is cleared. Not saved.	U16	RW	0
2007h	Limit parking method	0: stop. 1: Emergency stop. 2: invalid.	U16	RW/S	0
2008h	Initial speed	The initial speed when motion begins. Unit: r/min. Range: 1-300 r/min.	U16	RW/S	1r/min
2009h	Register parameter settings	0: invalid. 1: Restore factory settings. 2: Save all RW attribute parameters to EEPROM.	U16	RW	0
200Ah	Motor Max speed	Max operating speed of motor. Unit: r/min. Range: 1-1000 r/min.	U16	RW/S	1000
200Bh	Encoder wire number setting	0-4096	U16	RW/S	1024
200Ch	Motor pole pairs	4-64	U16	RW/S	15
200Dh	CAN custom drive node number	When the external dial switch is 0, 4 ~ 127 can be set; When the external dial switch is 1-3, this bit is invalid.	U16	RW/S	4
200Eh	High bit of CAN custom	0：1000 Kbit/s 1：500 Kbit/s	U16	RW/S	1

	communication baud rate	2：250 Kbit/s 3：125 Kbit/s 4：100 Kbit/s 5：50 Kbit/s 6：25 Kbit/s			
200Fh	Lock shaft method when power-on	0: Not enable, not lock the shaft. 1: Not enable, lock the shaft.	U16	RW/S	0
2010h	Whether store RW / S parameters in EEPROM synchronously	Whether the communication write function code value is updated to EEPROM. 0: Parameters with attribute RW/S are updated to EEPROM synchronously; 1: Not updated;	U16	RW	0
2011h	Offset angle of motor and Hall	Unit: 1 °; Range: -360~ +360.	I16	RW/S	0
2012h	Overload factor	Range: 0-300,.Unit: %;	U16	RW/S	200
2013h	Motor temperature protection threshold	Unit: 0.1 °C; Rang: 0-1200 (* 0.1).	U16	RW/S	800
2014h	Rated current	The rated current output by driver. Unit: 0.1A; Range: 0-150.	U16	RW/S	150
2015h	Max current	Max current output by driver. Unit: 0.1A; Range: 0-300.	U16	RW/S	300
2016h	Overload protection time	Driver overload protection time. Unit: 10ms; Range: 0-6553.	U16	RW/S	300
2017h	Out of tolerance alarm threshold	Encoder out-of-tolerance threshold. Unit: *10counts; Range: 1-6553.	U16	RW/S	409
2018h	Velocity smoothing factor	0-30000	U16	RW/S	1000
2019h	Current loop proportional coefficient	0-30000	U16	RW/S	600
201Ah	Current loop integral gain	0-30000	U16	RW/S	300
201Bh	Feedforward output smoothing coefficient	0-30000	U16	RW/S	100
201Ch	Torque output smoothing factor	0-30000	U16	RW/S	100
201Dh	Speed proportional gain Kp	0-30000	U16	RW/S	500
201Eh	Speed integral gain Ki	0-30000	U16	RW/S	100

201Fh	Speed feedforward gain Kf	0-30000	U16	RW/S	1000
2020h	Position proportional gain Kp	0-30000	U16	RW/S	50
2021h	Position feedforward gain Kf	0-30000	U16	RW/S	200
2022h	RS485 custom drive node number	When the external dial switch is 0, 4-127 can be set; When the external dial switch is 1-3, this bit is invalid.	U16	RW/S	4
2023h	High bit of RS485 custom communication baud rate	0：256000bps 1：128000bps 2：115200bps 3：57600bps 4：38400bps 5：19200bps 6：9600bps	U16	RW/S	2
2024h	Reserved	Reserved	Reserved	Reserved	Reserved
2025h	Software version	Factory default	U16	RO	-
2026h	Motor temperature	Unit: 0.1 °C; Range: 0-1200 (* 0.1).	U16	RO	-
2027h	Status word	Driver controls motor movement: 00 00: Shaft release 00 40: Shaft lock 00 80: Emergency stop 00 C0: Alarm Motor running status: bit0 0: Stop 1: Run	U16	RO	0
2028h	Hall input status	0-7; If 0 or 7 appears, there exists Hall error.	U16	RO	0
2029h	Bus voltage	Unit: 0.01V	U16	RO	0
202Ah	Actual position feedback high 16 bit	Actual position feedback, unit: counts.	I32	RO	0
202Bh	Actual position feedback low 16 bit				
202Ch	Actual speed feedback	Current motor speed, unit: 0.1r/min	I16	RO	0
202Dh	Real-time torque feedback	Unit: 0.1A Range: -300~300.	I16	RO	0
202Eh	The last error code of driver	Manufacturer-defined driver error conditions. 0000h: no error; 0001h: over-voltage;	U16	RO	0

		0002h: under-voltage; 0004h: over-current; 0008h: overload; 0010h: current is out of tolerance; 0020h: encoder is out of tolerance; 0040h: speed is out of tolerance; 0080h: reference voltage error; 0100h: EEPROM read and write error; 0200h: Hall error; 0400h: motor temperature is too high.			
202Fh	The connection bit between host computer and driver				
2030h	Reserved	Reserved	Reserved	Reserved	Reserved
2031h	Control word	Control word 0x05: emergency stop 0x06: alarm clear 0x07: stop 0x08: enable 0x10: start (required in Profile Position Mode)	U16	RW	0
2032h	Operating mode	0: undefined; 1: Profile Position Mode (absolute Profile Position Mode); 2: Profile Position Mode (relative Profile Position Mode); 3: Profile Velocity Mode; 4: Profile Torque Mode.	U16	RW	0
2033h	Target torque	Unit: mA Range: -30000 ~30000;	I16	RW	0
2034h	High 16 bits of target position	Range of total pulses in Profile Position Mode operation: -1000000~1000000	I16	RW	0
2035h	Low 16 bits of target position		I16	RW	0
2036h	Max speed	Max speed in Profile Position Mode; Range: 1-1000 r/min.	U16	RW	120r/min
2037h	S-type acceleration time	acceleration time; Range: 0-32767ms.	U16	RW	500ms
2038h	S-type deceleration time	deceleration time; Range: 0-32767ms.	U16	RW	500ms
2039h	Emergency stop deceleration time	deceleration time; Range: 0-32767ms.	U16	RW	10ms
203Ah	Target speed	Target speed in Profile Velocity Mode;	I16	RW	0

		Range: -1000-1000 r/min.			
203BH	Torque slope	Current/1000/second; Unit: mA/s;	U16	RW	300ms
203Ch	Emergency stop code	Driver processing mode after quick stop command. 5: Normal stop, maintain quick stop status; 6: Sudden deceleration stop, maintain quick stop state; 7: Emergency stop, maintain quick stop state.	U16	RW	5
203Dh	Close operation code	Driver processing method after close command. 0: invalid; 1: normal stop, turn to ready to switch on state;	U16	RW	1
203Eh	Disable operation codes	Driver processing mode after disabling operation command 0: invalid; 1: normal stop, turn to switched on state.	U16	RW	1
203Fh	Halt control register	Driver processing mode after control word Halt command. 1: Stop normally and maintain Operation Enabled state; 2: Sudden deceleration stop, maintain Operation Enabled state; 3: Emergency stop, maintain Operation Enabled state.	U16	RW	1
2040h	Profile Position Mode start /stop speed	Start/stop speed in Profile Position Mode; Range: 1-1000 r/min.	U16	RW	1r/min
2041h	Input terminal effective level	Bit0: input terminal X0 control bit; Bit1: input terminal X1 control bit; 0: default; 1: level reversal; The driver defaults input terminal level rising edge or high level is effective.	U16	RW/S	0
2042h	Input terminal X0 terminal function selection	0: undefined; 1-8: NC; 9: Emergency stop signal.	U16	RW/S	9
2043h	Input terminal X1 terminal function		U16	RW/S	0

	selection				
2044h	Output terminal effective level	Bit0: output terminal Y0 control bit; Bit1: output terminal Y1 control bit; 0: default; 1: level reversal; The driver defaults input terminal level rising edge or high level is effective.	U16	RW/S	0
2045h	Output terminal Y0 terminal function selection	0: undefined; 1: alarm signal; 2: driver status signal; 3: NC; 4: In position signal.	U16	RW/S	1
2046h	Output terminal Y1 terminal function selection	Brake open/close 0: open 1: close;	U16	RW	0
2054h	Alarm PWM processing method	0: close; 1: open	U16	RW/S	0
2055h	Overload processing method	0: close; 1: open	U16	RW/S	0
Note: U16 means unsigned 16 bits;I16 means signed 16 bits; U32 means unsigned 32 bits;I32 means signed 32 bits.					

Notice:

Alarm PWM processing method: After the driver enters the alarm state, the upper tube is turned off and the lower tube is turned on (short-circuit motor 3 power cables).

Overload processing method: for example, the motor I^2t time is 20s, the duration of double overload is 6 seconds, and the duration of triple overload is 4 seconds.