ZLAC8015D Servo Hub Motor Driver

RS485 communication description

1. RS485 serial port settings

RS485 of ZLAC8015D supports Modbus RTU protocol.

The drive address can be set from 0-127, the default is 1;

7 kinds of baud rates, such as 9600, 19200, 38400, 57600, 115200, 128000, 256000, etc.

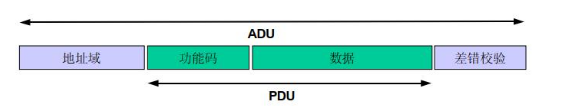
It can be set by software, the default is 115200;

Data bits 8, no parity, stop bit 1.

2. Protocol format

The MODBUS protocol defines a protocol data unit (PDU) independent of the underlying communication layer. specific bus

Or the MODBUS protocol mapping on the network can introduce some additional fields on the Application Data Unit (ADU).



The MODBUS protocol defines three PDUs:

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

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

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

The function codes supported by ZLAC8015 are as follows:

The function codes supported by ZLAC8015 are as follows:

|  |  |  |
| --- | --- | --- |
| Function description | function code | abnormal function code |
| read multiple registers | 0x03 | 0x83 |
| write a single register | 0x06 | 0x86 |
| write multiple registers | 0x10 | 0x90 |

The error codes are as follows:

|  |  |  |
| --- | --- | --- |
| error code | name | Meaning |
| 0x01 | Illegal function code | Function code error |
| 0x02 | illegal data address | data address error |
| 0x03 | illegal data value | data error |

2.1. Read register function code 0x03

Example: Send "Read Motor Actual Speed", return "Motor Actual Speed 10RPM"

Send

|  |  |
| --- | --- |
| Command | Content description |
| 01 | drive address |
| 03 | function code |
| 20 | Register start address upper eight bits |
| AB | Register start address lower eight bits |
| 00 | The high eight bits of the number of registers |
| 02 | The lower eight bits of the number of registers |
| BE | CRC check upper eight bits |
| 2B | CRC check low eight bits |

return data

|  |  |
| --- | --- |
| Command | Content description |
| 01 | drive address |
| 03 | function code |
| 04 | Read the number of data bytes |
| 00 | Data 0 high eight bits |
| 64 | Data 0 lower eight bits |
| 00 | Data 1 upper eight bits |
| 64 | Data 1 lower eight bits |
| BA | CRC check upper eight bits |
| 07 | CRC check low eight bits |

2.2 Write a single register function code 0x06

Example: write left motor target speed 100RPM

send

|  |  |
| --- | --- |
| Command | Content description |
| 01 | drive address |
| 06 | function code |
| 20 | Register start address upper eight bits |
| 88 | Register start address lower eight bits |
| 00 | Data high eight |
| 64 | Data lower eight bits |
| 03 | CRC check upper eight bits |
| CB | CRC check low eight bits |

return data

|  |  |
| --- | --- |
| Command | Content description |
| 01 | drive address |
| 06 | function code |
| 20 | Register start address upper eight bits |
| 88 | Register start address lower eight bits |
| 00 | Data high eight |
| 64 | Data lower eight bits |
| 03 | CRC check upper eight bits |
| CB | CRC check low eight bits |

2.3 Write multiple registers function code 0x10

Example: write left motor encoder line number 1024, hall offset angle 0

send

|  |  |
| --- | --- |
| Command | Content description |
| 01 | drive address |
| 10 | function code |
| 20 | Register start address upper eight bits |
| 30 | Register start address lower eight bits |
| 00 | The high eight bits of the number of registers |
| 02 | The lower eight bits of the number of registers |
| 04 | number of data bytes |
| 04 | Data 0 high eight bits |
| 00 | Data 0 lower eight bits |
| 00 | Data 1 upper eight bits |
| 00 | Data 1 lower eight bits |
| 68 | CRC check upper eight bits |
| 4A | CRC check low eight bits |

return data

|  |  |
| --- | --- |
| Command | Content description |
| 01 | drive address |
| 10 | function code |
| 20 | Register start address upper eight bits |
| 30 | Register start address lower eight bits |
| 02 | The high eight bits of the number of registers |
| 4A | The lower eight bits of the number of registers |
| 07 | CRC check upper eight bits |
| 01 | CRC check low eight bits |

3. Control routine

3.1 Speed Mode

The relevant parameter addresses are as follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Index | Name | instruction | type | property | Default |
| 200Eh | control word | control word  0x05: Emergency stop  0x06: Alarm clear  0x07: Downtime  0x08: enable | U16 | RW | 0 |
| 200Dh | operating mode | 3: speed mode; | U16 | RW | 0 |
| 2080h | S-shaped acceleration time (left motor) | acceleration time;  Range: 0-32767ms; | U16 | RW | 500ms |
| 2081h | S-shaped acceleration time (right motor) | acceleration time;  Range: 0-32767ms; | U16 | RW | 500ms |
| 2082h | S-shaped deceleration time (left motor) | deceleration time;  Range: 0-32767ms; | U16 | RW | 500ms |
| 2083h | S-shaped deceleration time (right motor) | deceleration time;  Range: 0-32767ms; | U16 | RW | 500ms |
| 2088h | Left motor target speed | target speed in speed mode;  Range: -3000-3000r/min; | I16 | RW | 0 |
| 2089h | Right motor target speed | target speed in speed mode;  Range: -3000-3000r/min; | I16 | RW | 0 |
| 20ABh | Actual speed feedback (left) | The current motion speed of the motor, the unit is 0.1r/min | I16 | RO | 0 |
| 20ACh | Actual speed feedback (right) | The current motion speed of the motor, the unit is 0.1r/min | I16 | RO | 0 |

Speed mode initialization

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| Set speed mode | 01 06 20 0D 00 03 53 C8 | 01 06 20 0D 00 03 53 C8 |
| Set the left motor  S-type acceleration time 500ms | 01 06 20 80 01 F4 83 F5 | 01 06 20 80 01 F4 83 F5 |
| Set the right motor  S-type acceleration time 500ms | 01 06 20 81 01 F4 D2 35 | 01 06 20 81 01 F4 D2 35 |
| Set the left motor  S-type deceleration time 500ms | 01 06 20 82 01 F4 22 35 | 01 06 20 82 01 F4 22 35 |
| Set the right motor  S-type deceleration time 500ms | 01 06 20 83 01 F4 73 F5 | 01 06 20 83 01 F4 73 F5 |
| Enable | 01 06 20 0E 00 08 E2 0F | 01 06 20 0E 00 08 E2 0F |

Left motor speed control

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| Set the left motor  Target speed 100RPM | 01 06 20 88 00 64 03 CB | 01 06 20 88 00 64 03 CB |
| Set the left motor  Target speed-100RPM | 01 06 20 88 FF 9C 43 B9 | 01 06 20 88 FF 9C 43 B9 |
| downtime | 01 06 20 31 00 07 92 07 | 01 06 20 31 00 07 92 07 |

Right motor speed control

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| Set the right motor  Target speed 100RPM | 01 06 20 89 00 64 52 0B | 01 06 20 89 00 64 52 0B |
| Set the right motor  Target speed-100RPM | 01 06 20 89 FF 9C 12 79 | 01 06 20 89 FF 9C 12 79 |
| downtime | 01 06 20 31 00 07 92 07 | 01 06 20 31 00 07 92 07 |

Synchronous speed control

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| set sync  Target speed 100RPM | 01 10 20 88 00 02 04 00 64 00 64 23 9C | 01 10 20 88 00 02 CA 22 |
| set sync  Target speed-100RPM | 01 10 20 88 00 02 04 FF 9C FF 9C D2 0B | 01 10 20 88 00 02 CA 22 |
| downtime | 01 06 20 31 00 07 92 07 | 01 06 20 31 00 07 92 07 |

3.2 Position Mode

The relevant parameter addresses are as follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| index | name | instruction | Type | Property | Default |
| 200Eh | control word | control word  0x05: Emergency stop  0x06: Alarm clear  0x07: Downtime  0x08: enable  0x10: start (sync) (position mode  required below)  0x11: Start (left motor)  0x12: start (right motor) | U16 | RW | 0 |
| 200Fh | Synchronous/Asynchronous Control Flag | 0: Asynchronous control  1: Synchronous control | U16 | RW | 0 |
| 200Dh | operating mode | 1: position mode (relative position mode);  2: position mode (absolute position mode); | U16 | RW | 0 |
| 2080h | Left motor S-curve acceleration time | acceleration time;  Range: 0-32767ms; | U16 | RW | 500ms |
| 2081h | Right motor S-curve acceleration time | acceleration time;  Range: 0-32767ms; | U16 | RW | 500ms |
| 2082h | Left motor S-curve deceleration time | deceleration time;  Range: 0-32767ms; | U16 | RW | 500ms |
| 2083h | Right motor S-curve deceleration time | deceleration time;  Range: 0-32767ms; | U16 | RW | 500ms |
| 208Ah | Left motor target position high 16 bit | The range of the total number of pulses in position mode operation:  Relative: -0x7FFFFFFF~0x7FFFFFFF;  absolute: -0x3FFFFFFF~0x3FFFFFFF; | I16 | RW | 0 |
| 208Bh | Left motor target position low 16  bit | I16 | RW | 0 |
| 208Ch | Right motor target position high 16  bit | The range of the total number of pulses in position mode operation:  Relative: -0x7FFFFFFF~0x7FFFFFFF;  absolute: -0x3FFFFFFF~0x3FFFFFFF; | I16 | RW | 0 |
| 208Dh | Right motor target position low 16  bit | I16 | RW | 0 |
| 208Eh | Left motor maximum speed | Maximum speed in position mode;  Range: 1-1000r/min; | U16 | RW | 120r/min |
| 208Fh | Right motor maximum speed | Maximum speed in position mode;  Range: 1-1000r/min; | U16 | RW | 120r/min |
| 20A7h | Actual position feedback position high  16 bit (left) | Actual position feedback, unit counts;  -0x7FFFFFFF~0x7FFFFFFFF; | I16 | RO | 0 |
| 20A8h | Actual position feedback position low  16 bit (left) | I16 | RO | 0 |
| 20A9h | Actual position feedback position high  16 bit (right) | Actual position feedback, unit counts;  -0x7FFFFFFF~0x7FFFFFFFF; | I16 | RO | 0 |
| 20AAh | Actual position feedback position low  16 bit (right) | I16 | RO | 0 |

Position mode asynchronous control initialization

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| Set up asynchronous control | 01 06 20 0F 00 00 B2 09 |  |
| Set relative position mode | 01 06 20 0D 00 01 D2 09 |  |
| Set the left motor  S-type acceleration time 500ms | 01 06 20 80 01 F4 83 F5 | 01 06 20 80 01 F4 83 F5 |
| Set the right motor  S-type acceleration time 500ms | 01 06 20 81 01 F4 D2 35 | 01 06 20 81 01 F4 D2 35 |
| Set the left motor  S-type deceleration time 500ms | 01 06 20 82 01 F4 22 35 | 01 06 20 82 01 F4 22 35 |
| Set the right motor  S-type deceleration time 500ms | 01 06 20 83 01 F4 73 F5 | 01 06 20 83 01 F4 73 F5 |
| Set the left motor Maximum speed 50RPM | 01 06 20 8E 00 32 63 F4 | 01 06 20 8E 00 32 63 F4 |
| Set the right motor  Maximum speed 50RPM | 01 06 20 8F 00 32 32 34 | 01 06 20 8F 00 32 32 34 |
| Enable | 01 06 20 0E 00 08 E2 0F | 01 06 20 0E 00 08 E2 0F |
|  |  |  |

Left motor relative position control

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| Set the left motor  Target position 20480pulses | 01 10 20 8A 00 02 04 00 00 50 00 DE 71 | 01 10 20 8A 00 02 6B E2 |
| left motor start | 01 06 20 0E 00 11 23 C5 | 01 06 20 0E 00 11 23 C5 |
| Set the left motor  target location - 20480pulses | 01 10 20 8A 00 02 04 FF FF B0 00 97 95 | 01 10 20 8A 00 02 6B E2 |
| left motor start | 01 06 20 0E 00 11 23 C5 | 01 06 20 0E 00 11 23 C5 |
| downtime | 01 06 20 0E 00 07 A2 0B | 01 06 20 0E 00 07 A2 0B |

Right motor relative position control

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| Set the right motor  Target position 20480pulses | 01 10 20 8C 00 02 04 00 00 50 00 5E 5B | 01 10 20 8C 00 02 8B E3 |
| Right motor starts | 01 06 20 0E 00 11 23 C501 06 20 0E 00 12 63 C4 | 01 06 20 0E 00 12 63 C4 |
| Set the right motor  target location - 20480pulses | 01 10 20 8C 00 02 04 FF FF B0 00 17 BF | 01 10 20 8C 00 02 8B E3 |
| Right motor starts | 01 06 20 0E 00 12 63 C4 | 01 06 20 0E 00 12 63 C4 |
| downtime | 01 06 20 0E 00 07 A2 0B | 01 06 20 0E 00 07 A2 0B |

Position mode synchronization control initialization

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| Set up sync control | 01 06 20 0F 00 01 73 C9 | 01 06 20 0F 00 01 73 C9 |
| Set relative position mode | 01 06 20 0D 00 01 D2 09 | 01 06 20 0D 00 01 D2 09 |
| Set the left motor  S-type acceleration time 500ms | 01 06 20 80 01 F4 83 F5 | 01 06 20 80 01 F4 83 F5 |
| Set the right motor  S-type acceleration time 500ms | 01 06 20 81 01 F4 D2 35 | 01 06 20 81 01 F4 D2 35 |
| Set the left motor  S-type deceleration time 500ms | 01 06 20 82 01 F4 22 35 | 01 06 20 82 01 F4 22 35 |
| Set the right motor  S-type deceleration time 500ms | 01 06 20 83 01 F4 73 F5 | 01 06 20 83 01 F4 73 F5 |
| Set the left motor  Maximum speed 50RPM | 01 06 20 8E 00 32 63 F4 | 01 06 20 8E 00 32 63 F4 |
| Set the right motor  Maximum speed 50RPM | 01 06 20 8F 00 32 32 34 | 01 06 20 8F 00 32 32 34 |
| Enable | 01 06 20 0E 00 08 E2 0F | 01 06 20 0E 00 08 E2 0F |

Synchronized relative position control

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| set sync  Target position 20480pulses | 01 10 20 8A 00 04 08 00 00 50 00 00 00 50 00 E3 2C | 01 10 20 8A 00 04 EB E0 |
| start up | 01 06 20 0E 00 10 E2 05 | 01 06 20 0E 00 10 E2 05 |
| set sync  target location - 20480pulses | 01 10 20 8A 00 04 08 FF FF B0 00 FF FF B0 00 FC A3 | 01 10 20 8A 00 04 EB E0 |
| start up | 01 06 20 0E 00 10 E2 05 | 01 06 20 0E 00 10 E2 05 |
| downtime | 01 06 20 0E 00 07 A2 0B | 01 06 20 0E 00 07 A2 0B |

3.3 Torque Mode

The relevant parameter addresses are as follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| index | name | instruction | type | Attributes | Defaults |
| 200Eh | control word | control word  0x05: Emergency stop  0x06: Alarm clear  0x07: Downtime  0x08: enable | U16 | RW | 0 |
| 200Dh | operating mode | 4: Torque mode; | U16 | RW | 0 |
| 2086h | Left motor torque slope | current/1000/second;  Unit: mA/S; | U16 | RW | 300ms |
| 2087h | Right motor torque slope | current/1000/second;  Unit: mA/S; | U16 | RW | 300ms |
| 2090h | Left motor target torque | Unit: mA  Range: -30000~30000; | I16 | RW | 0 |
| 2091h | Right motor target torque | Unit: mA  Range: -30000~30000; | I16 | RW | 0 |
| 20ADh | Real-time torque feedback (left) | Unit: 0.1A  Range: -300~300; | I16 | RO | 0 |
| 20AEh | Real-time torque feedback (right) | Unit: 0.1A  Range: -300~300; | I16 | RO | 0 |

Torque mode initialization

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| Set torque mode | 01 06 20 0D 00 04 12 0A | 01 06 20 0D 00 04 12 0A |
| Set the left motor  Torque slope 500mA/s | 01 06 20 86 01 F4 63 F4 | 01 06 20 86 01 F4 63 F4 |
| Set the right motor  Torque slope 500mA/s | 01 06 20 87 01 F4 32 34 | 01 06 20 87 01 F4 32 34 |
| motor enable | 01 06 20 31 00 08 D2 03 | 01 06 20 31 00 08 D2 03 |

Left motor torque control

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| Set the left motor  Target torque 2000mA | 01 06 20 90 07 D0 81 8B | 01 06 20 90 07 D0 81 8B |
| Set the left motor  Target torque -2000mA | 01 06 20 90 F8 30 C1 F3 | 01 06 20 90 F8 30 C1 F3 |
| downtime | 01 06 20 0E 00 07 A2 0B | 01 06 20 0E 00 07 A2 0B |

Right motor torque control

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| Set the right motor  Target torque 2000mA | 01 06 20 91 07 D0 D0 4B | 01 06 20 91 07 D0 D0 4B |
| Set the right motor  Target torque -2000mA | 01 06 20 91 F8 30 90 33 | 01 06 20 91 F8 30 90 33 |
| downtime | 01 06 20 0E 00 07 A2 0B | 01 06 20 0E 00 07 A2 0B |

Synchronous torque control

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| set sync  Target torque 2000mA | 01 10 20 90 00 02 04 07 D0 07 D0 60 23 | 01 10 20 90 00 02 4A 25 |
| set sync  Target torque -2000mA | 01 10 20 90 00 02 04 F8 30 F8 30 11 B9 | 01 10 20 90 00 02 4A 25 |
| downtime | 01 06 20 0E 00 07 A2 0B | 01 06 20 0E 00 07 A2 0B |

3.5 Emergency stop command and external emergency stop

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| index | name | instruction | type | Attributes | default |
| 200Eh | control word | 0x05: Emergency stop  0x06: Alarm clear  0x07: Downtime  0x08: enable  0x10: start (required in position mode) | U16 | RW | 0 |
| 2016h | Input terminal effective level | Bit0: Control bit of input terminal X0;  Bit1: Input terminal X1 control bit;  0: default;  1: level inversion;  The driver defaults to the rising edge of the input terminal level or  Active high; | U16 | RW/S | 0 |
| 2017h | Input terminal X0 Terminal function selection | 0: undefined;  1-8: NC;  9: Emergency stop signal; | U16 | RW/S | 9 |
| 2018h | Input terminal X1 terminal function  can choose | U16 | RW/S | 0 |

※Note: Please refer to the "ZLAC8015D Servo Hub Driver User Manual" for the external wiring diagram of the input port.

Emergency stop command:

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| emergency stop | 01 06 20 0E 00 05 23 CA | 01 06 20 0E 00 05 23 CA |

3.6 Troubleshooting and Clearing

ZLAC8015D supports overvoltage, overcurrent protection, etc. All fault information can be read through the address 0x20A5/0x20A6 (left/

right drive) to get

The fault codes are as follows:

|  |  |
| --- | --- |
| 0x603F | Function description |
| 0x0000 | no errors |
| 0x0001 | overvoltage |
| 0x0002 | undervoltage |
| 0x0004 | overcurrent |
| 0x0008 | overload |
| 0x0010 | Current out of tolerance |
| 0x0020 | Encoder out of tolerance |
| 0x0040 | Too bad |
| 0x0080 | reference voltage error |
| 0x0100 | EEPROM read and write errors |
| 0x0200 | Hall went wrong |
| 0x0400 | Motor temperature is too high |

fault clearing

|  |  |  |
| --- | --- | --- |
| instruction | send | recv |
| clear fault | 01 06 20 0E 00 06 63 CB | 01 06 20 0E 00 06 63 CB |

Appendix A Address Directory