**Servo Motor Control Protocol V3.8**

**Disclaimer**

Thanks for choosing RMD series motor.Please read this statement carefully before using.Once used, this statement is deemed to be approved and accepted.Please install and use this product strictly in accordance with the manual, product description and relevant laws, regulations, policies and guidelines. In the process of using the product, the user undertakes to be responsible for his own behavior and all consequences arising therefrom. MYACTUATOR will not be liable for any loss caused by improper use, installation and modification of the user.

MYACTUATOR is the trademark of Suzhou Micro Actuator Technology Co., Ltd. and its affiliates. Product names, brands, etc. appearing in this document are trademarks or registered trademarks of their respective companies.

This product and manual are copyrighted by MYACTUATOR. Reproduction in any form is not permitted without permission. The final interpretation right of the disclaimer belongs to MYACTUATOR.

**Catalogue**

[1. Communication Bus Parameters and Message Format 9](#_Toc27365)

[1.1.CAN Bus 9](#_Toc9647)

[1.1.1. Parameters 9](#_Toc5232)

[1.1.2. Message format 9](#_Toc11965)

[1.2.RS485 bus 9](#_Toc8281)

[1.2.1. Parameters 9](#_Toc28014)

[1.2.2. Message format 9](#_Toc13858)

[2. Single motor command description 10](#_Toc19229)

[2.1. Read PID parameter command (0x30) 10](#_Toc534)

[2.1.1. Instruction description 10](#_Toc29147)

[2.1.2. Send data field definition 10](#_Toc16685)

[2.1.3. Reply data field definition 10](#_Toc8515)

[2.1.4. Communication example 11](#_Toc22800)

[2.2. Write PID parameters to RAM command (0x31) 13](#_Toc8938)

[2.2.1. Instruction description 13](#_Toc17737)

[2.2.2. Send data field definition 13](#_Toc9046)

[2.2.3. Reply data field definition 13](#_Toc10976)

[2.2.4. Communication example 13](#_Toc7072)

[2.3. Write PID parameters to ROM command (0x32) 15](#_Toc11765)

[2.3.1. Instruction description 15](#_Toc6443)

[2.3.2. Send data field definition 15](#_Toc16664)

[2.3.3. Reply data field definition 15](#_Toc23578)

[2.3.4. Communication example 16](#_Toc9322)

[2.4. Read acceleration command (0x42) 17](#_Toc19048)

[2.4.1. Instruction description 17](#_Toc15059)

[2.4.2. Send data field definition 17](#_Toc25808)

[2.4.3. Reply data field definition 18](#_Toc19917)

[2.4.4. Communication example 18](#_Toc5097)

[2.5. Write acceleration to RAM and ROM command (0x43) 18](#_Toc23696)

[2.5.1. Instruction description 18](#_Toc5915)

[2.5.2. Send data field definition 19](#_Toc14760)

[2.5.3. Reply data field definition 19](#_Toc27746)

[2.5.4. Function Index Description 19](#_Toc4672)

[2.5.5 Communication example 19](#_Toc32501)

[2.6. Read multi-turn encoder position data command (0x60) 22](#_Toc5275)

[2.6.1. Instruction description 22](#_Toc7238)

[2.6.2. Send data field definition 23](#_Toc22429)

[2.6.3. Reply data field definition 23](#_Toc27136)

[2.6.4. Communication example 24](#_Toc29519)

[2.7. Read multi-turn encoder original position data command (0x61) 24](#_Toc11496)

[2.7.1. Instruction description 24](#_Toc31422)

[2.7.2. Send data field definition 24](#_Toc28619)

[2.7.3. Reply data field definition 25](#_Toc18860)

[2.7.4. Communication example 25](#_Toc21217)

[2.8. Read multi-turn encoder zero offset data command (0x62) 26](#_Toc27880)

[2.8.1. Instruction description 26](#_Toc20304)

[2.8.2. Send data field definition 26](#_Toc25164)

[2.8.3. Reply data field definition 27](#_Toc22449)

[2.8.4. Communication example 27](#_Toc5544)

[2.9. Write encoder multi-turn value to ROM as motor zero command (0x63) 28](#_Toc17857)

[2.9.1. Instruction description 28](#_Toc27183)

[2.9.2. Send data field definition 28](#_Toc23582)

[2.9.3. Reply data field definition 29](#_Toc17028)

[2.9.4. Communication example 29](#_Toc25776)

[2.10. Write the current multi-turn position of the encoder to the ROM as the motor zero command (0x64) 30](#_Toc24840)

[2.10.1. Instruction description 30](#_Toc23196)

[2.10.2. Send data field definition 30](#_Toc7292)

[2.10.3. Reply data field definition 30](#_Toc7095)

[2.10.4. Communication example 31](#_Toc7524)

[2.11. Read single-turn encoder command (0x90) 32](#_Toc28784)

[2.11.1. Instruction Description 32](#_Toc11402)

[2.11.2. Send data field definition 32](#_Toc24625)

[2.11.3. Reply data field definition 32](#_Toc13899)

[2.11.4. Example of communication 33](#_Toc9725)

[2.12. Read multi-turn angle command (0x92) 34](#_Toc29011)

[2.12.1. Instruction description 34](#_Toc3115)

[2.12.2. Send data field definition 34](#_Toc5905)

[2.12.3. Reply data field definition 34](#_Toc8260)

[2.12.4. Communication example 35](#_Toc3240)

[2.13. Read single-turn angle command (0x94) 35](#_Toc24175)

[2.13.1. Instruction Description 35](#_Toc22386)

[2.13.2. Send data field definition 36](#_Toc18388)

[2.13.3. Reply data field definition 36](#_Toc12572)

[2.13.4. Example of communication 37](#_Toc8171)

[2.14. Read Motor Status 1 and Error Flag Command (0x9A) 38](#_Toc8598)

[2.14.1. Instruction description 38](#_Toc13831)

[2.14.2. Send data field definition 38](#_Toc8838)

[2.14.3. Reply data field definition 38](#_Toc12805)

[2.14.4. Communication example 39](#_Toc19783)

[2.15. Read Motor Status 2 Command (0x9C) 40](#_Toc1071)

[2.15.1. Instruction description 40](#_Toc21405)

[2.15.2. Send data field definition 41](#_Toc7760)

[2.15.3. Reply data field definition 41](#_Toc4851)

[2.15.4. Communication example 41](#_Toc30662)

[2.16. Read Motor Status 3 Command (0x9D) 43](#_Toc32325)

[2.16.1. Instruction description 43](#_Toc5202)

[2.16.2. Send data field definition 43](#_Toc15422)

[2.16.3. Reply data field definition 43](#_Toc4658)

[2.16.4. Communication example 44](#_Toc17244)

[2.17. Motor shutdown command (0x80) 45](#_Toc577)

[2.17.1. Instruction description 45](#_Toc19478)

[2.17.2. Send data field definition 45](#_Toc8697)

[2.17.3. Reply data field definition 45](#_Toc29019)

[2.17.4. Communication example 45](#_Toc3712)

[2.18. Motor stop command (0x81) 45](#_Toc23013)

[2.18.1. Instruction description 45](#_Toc298)

[2.18.2. Send data field definition 45](#_Toc22829)

[2.18.3. Reply data field definition 46](#_Toc26910)

[2.18.4. Communication example 46](#_Toc11531)

[2.19. Torque closed-loop control command (0xA1) 46](#_Toc4857)

[2.19.1. Instruction description 46](#_Toc25922)

[2.19.2. Send data field definition 46](#_Toc22176)

[2.19.3. Reply data field definition 47](#_Toc11403)

[2.19.4. Communication example 47](#_Toc17577)

[2.20. Speed Closed-loop Control Command (0xA2) 49](#_Toc9951)

[2.20.1. Instruction description 50](#_Toc22528)

[2.20.2. Send data field definition 50](#_Toc30468)

[2.20.3. Reply data field definition 50](#_Toc5551)

[2.20.4. Communication example 51](#_Toc19896)

[2.21. Absolute position closed-loop control command (0xA4) 53](#_Toc5109)

[2.21.1. Instruction description 53](#_Toc14052)

[2.21.2. Send data field definition 53](#_Toc27412)

[2.21.3. Reply data field definition 54](#_Toc15808)

[2.21.4. Communication example 54](#_Toc25973)

[2.22. Single-turn position control command (0xA6) 57](#_Toc1752)

[2.22.1. Instruction Description 57](#_Toc12827)

[2.22.2. Send data field definition 58](#_Toc14144)

[2.22.3. Reply data field definition 58](#_Toc13176)

[2.22.4. Example of communication 59](#_Toc31367)

[2.23. Incremental position closed-loop control command (0xA8) 61](#_Toc21282)

[2.23.1. Instruction description 61](#_Toc9443)

[2.23.2. Send data field definition 61](#_Toc24646)

[2.23.3. Reply data field definition 62](#_Toc23386)

[2.23.4. Communication example 62](#_Toc25811)

[2.24. System operating mode acquisition (0x70) 65](#_Toc4341)

[2.24.1. Instruction description 65](#_Toc18649)

[2.24.2. Send data field definition 65](#_Toc27265)

[2.24.3. Reply data field definition 65](#_Toc28418)

[2.24.4. Communication example 66](#_Toc5319)

[2.25. Motor power acquisition (0x71) 66](#_Toc31377)

[2.25.1. Instruction description 66](#_Toc12565)

[2.25.2. Send data field definition 66](#_Toc20048)

[2.25.3. Reply data field definition 67](#_Toc2814)

[2.25.4. Communication example 67](#_Toc21448)

[2.26. System reset command (0x76) 68](#_Toc2329)

[2.26.1. Instruction description 68](#_Toc21895)

[2.26.2. Send data field definition 68](#_Toc6349)

[2.26.3. Reply data field definition 69](#_Toc19514)

[2.26.4. Communication example 69](#_Toc5483)

[2.27. System brake release command (0x77) 69](#_Toc15838)

[2.27.1. Instruction description 69](#_Toc27939)

[2.27.2. Send data field definition 69](#_Toc1894)

[2.27.3. Reply data field definition 70](#_Toc6809)

[2.27.4. Communication example 70](#_Toc27769)

[2.28. System brake lock command (0x78) 70](#_Toc34)

[2.28.1. Instruction description 70](#_Toc26168)

[2.28.2. Send data field definition 70](#_Toc23030)

[2.28.3. Reply data field definition 70](#_Toc12592)

[2.28.4. Communication example 70](#_Toc26324)

[2.29. System runtime read command (0xB1) 71](#_Toc23524)

[2.29.1. Instruction description 71](#_Toc8941)

[2.29.2. Send data field definition 71](#_Toc25233)

[2.29.3. Reply data field definition 71](#_Toc3865)

[2.29.4. Communication example 71](#_Toc2581)

[2.30. System software version date read command (0xB2) 72](#_Toc3734)

[2.30.1. Instruction description 72](#_Toc31528)

[2.30.2. Send data field definition 72](#_Toc30692)

[2.30.3. Reply data field definition 73](#_Toc26695)

[2.30.4. Communication example 73](#_Toc6535)

[2.31. Communication interruption protection time setting command (0xB3) 74](#_Toc7166)

[2.31.1. Instruction description 74](#_Toc14759)

[2.31.2. Send data field definition 74](#_Toc31345)

[2.31.3. Reply data field definition 75](#_Toc4077)

[2.31.4. Communication example 75](#_Toc6239)

[2.32. Communication baud rate setting command (0xB4) 76](#_Toc29452)

[2.32.1. Instruction description 76](#_Toc23272)

[2.32.2. Send data field definition 77](#_Toc32731)

[2.32.3. Reply data field definition 77](#_Toc28384)

[2.32.4. Communication example 77](#_Toc28134)

[2.33. Motor model reading command (0xB5) 79](#_Toc7040)

[2.33.1. Instruction description 79](#_Toc9697)

[2.33.2. Send data field definition 79](#_Toc21409)

[2.33.3. Reply data field definition 79](#_Toc4199)

[2.33.4. Communication example 79](#_Toc16884)

[2.34. Function control command (0x20) 80](#_Toc2017)

[2.34.1. Instruction description 80](#_Toc12240)

[2.34.2. Send data field definition 80](#_Toc28307)

[2.34.3. Reply data field definition 81](#_Toc25480)

[2.34.4. Function Index Description 81](#_Toc14958)

[2.34.5. Communication example 81](#_Toc4084)

[3. Multi-motor command (0x280 + command) 83](#_Toc9196)

[3.1. Instruction description 83](#_Toc19094)

[3.2. Communication example 83](#_Toc3670)

[4. CANID setting command (0x79) 85](#_Toc15760)

[4.1. Instruction description 85](#_Toc7012)

[4.2. Send data field definition 85](#_Toc28306)

[4.3. Reply data field definition 86](#_Toc24955)

[4.4. Communication example 86](#_Toc27672)

[5. Motion Mode Control Command\_CAN (0x400 + ID) 87](#_Toc26662)

[5.1. Instruction Description 87](#_Toc3707)

[5.2. Send data field definition 88](#_Toc16753)

[5.3. Reply data field definition 88](#_Toc5730)

[5.4. Communication example 89](#_Toc28419)

[6. RS485 multi-motor command (0xCD + command) 90](#_Toc15343)

[6.1. Command description 90](#_Toc31023)

[6.2. Example of communication 90](#_Toc7193)

[7. RS485-ID setting command (0x79) 93](#_Toc23598)

[7.1. Instruction Description 93](#_Toc12411)

[7.2. Send Data Field Definition 94](#_Toc18038)

[7.3. Reply data field definition 94](#_Toc22100)

[7.4. Communication example 94](#_Toc20985)

[8.Indicator Light Description 95](#_Toc15166)

[8.1 Status Description 95](#_Toc4356)

[8.2 Failure Description Form 95](#_Toc10339)

[9. Version revision information 97](#_Toc28639)

**1. Communication Bus Parameters and Message Format**

**1.1.CAN Bus**

**1.1.1. Parameters**

Bus interface: CAN

Baud rate: 1Mbps

**1.1.2. Message format**

Identifier: Single motor command sending: 0x140 + ID(1~32)

Multi-motor command sending: 0x280

Reply: 0x240 + ID (1~32)

Frame format: data frame

Frame Type: Standard Frame

DLC: 8 bytes

**1.2.RS485 bus**

**1.2.1. Parameters**

Bus interface: RS485

Baudrate:115200bps，500Kbps，1Mbps，1.5Mbps，2Mbps.

**1.2.2. Message format**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Data Defination** | **Bytes** | **Description** |
| Frame header | 0x3E | 1 | Communication frame header, used for identification. |
| ID | 1~32 | 1 | Device address, corresponding to the ID number of each motor. |
| Data Length | Data Length | 1 | The length of the data field. In the standard protocol, the length is fixed to 8 bytes. |
| Data field | Data content | According to the length | The content of the data field in the standard protocol is exactly the same as that of the CAN. |
| Check | CRC Check | 2 | CRC16 check, low order first, high order last. |

**2. Single motor command description**

**2.1. Read PID parameter command (0x30)**

**2.1.1. Instruction description**

This command can read the parameters of current, speed, position loop KP and KI at one time, and the data type is uint8\_t. The system sets the maximum range of PI parameters according to the motor model, and then divides it equally according to the maximum range of uint8\_t of 256 units. Users only need to adjust 0-256 units.

**2.1.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **Data field** | **Description** | **Data** |
| DATA[0] | Command byte | 0x30 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.1.3. Reply data field definition**

|  |  |  |
| --- | --- | --- |
| **Data field** | **Description** | **Data** |
| DATA[0] | Command byte | 0x30 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | Current loop KP parameters | DATA[2] = (uint8\_t)(CurrKP) |
| DATA[3] | Current loop KI parameters | DATA[3] = (uint8\_t)(CurrKI) |
| DATA[4] | Speed loop KP parameters | DATA[4] = (uint8\_t)(SpdKP) |
| DATA[5] | Speed loop KI parameters | DATA[5] = (uint8\_t)(SpdKI) |
| DATA[6] | Position loop KP parameters | DATA[6] = (uint8\_t)(PosKP) |
| DATA[7] | Position loop KI parameters | DATA[7] = (uint8\_t)(PosKI) |

**2.1.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x30 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x30 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x30 | CRC16L | CRC16H |

**Description:** Send command to read PID parameters.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x30 | 0x00 | 0x55 | 0x19 | 0x55 | 0x19 | 0x55 | 0x19 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x30 | 0x00 | 0x55 | 0x19 | 0x55 | 0x19 | 0x55 | 0x19 | CRC16L | CRC16H |

**Description:**

Data[2] represents the current loop KP parameter, 0x55 decimal represents 85, assuming that the maximum value of the current loop set by the system is 3, then the actual value of 1 unit is 3/256 = 0.01171875, and 85 units represent the actual value 85\*0.01171875 = 0.99609375, which is the actual value of the KP parameter of the current loop inside the system.

Data[3] represents the current loop KI parameter, 0x19 decimal represents 25, assuming that the maximum value of the current loop set by the system is 0.1, then the actual value of 1 unit is 0.1/256 = 0.00039062, and 25 units represent the actual value of 25\* 0.00039062 = 0.0097656, which is the actual value of the KI parameter of the current loop inside the system.

Data[4] represents the KP parameter of the speed loop, and 0x55 in decimal represents 85. Assuming that the maximum value of the speed loop set by the system is 0.1, the actual value of 1 unit is 0.1/256 = 0.00039062, and 85 units represent the actual value of 85\* 0.00039062 = 0.0332027, this is the actual value of the KP parameter of the internal speed loop of the system.

Data[5] represents the speed loop KI parameter, 0x19 decimal represents 25, assuming that the maximum speed loop set by the system is 0.01, then the actual value of 1 unit is 0.01/256 = 0.00003906, and 25 units means the actual value is 25\* 0.00003906 = 0.0009765, this is the actual value of the KI parameter of the speed loop inside the system.

Data[6] represents the KP parameter of the position loop, 0x55 in decimal means 85, assuming that the maximum value of the position loop set by the system is 0.1, then the actual value of 1 unit is 0.1/256 = 0.00039062, and 85 units means the actual value is 85\* 0.00039062 = 0.0332027, this is the actual value of the KP parameter of the internal position loop of the system.

Data[7] represents the position loop KI parameter, 0x19 decimal represents 25, assuming that the maximum value of the position loop set by the system is 0.01, then the actual value of 1 unit is 0.01/256 = 0.00003906, and 25 units means the actual value is 25\* 0.00003906 = 0.0009765, which is the actual value of the KI parameter of the internal position loop of the system.

**2.2. Write PID parameters to RAM command (0x31)**

**2.2.1. Instruction description**

This command can write the parameters of current, speed, position loop KP and KI to RAM at one time, and it will not be saved after power off. The data type is uint8\_t. The system sets the maximum range of PI parameters according to the motor model, and then divides it equally according to the maximum range of uint8\_t of 256 units. Users only need to adjust 0-256 units.

**2.2.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **Data field** | **Description** | **Data** |
| DATA[0] | Command byte | 0x31 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | Current loop KP parameter | DATA[2] = (uint8\_t)(CurrKP) |
| DATA[3] | Current loop KI parameter | DATA[3] = (uint8\_t)(CurrKI) |
| DATA[4] | Speed loop KP parameter | DATA[4] = (uint8\_t)(SpdKP) |
| DATA[5] | Speed loop KI parameter | DATA[5] = (uint8\_t)(SpdKI) |
| DATA[6] | Position loop KP parameter | DATA[6] = (uint8\_t)(PosKP) |
| DATA[7] | Position loop KI parameter | DATA[7] = (uint8\_t)(PosKI) |

**2.2.3. Reply data field definition**

The content of the reply data is the same as the sent data.

**2.2.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x31 | 0x00 | 0x55 | 0x19 | 0x55 | 0x19 | 0x55 | 0x19 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x31 | 0x00 | 0x55 | 0x19 | 0x55 | 0x19 | 0x55 | 0x19 | CRC16L | CRC16H |

**Description:**

Data[2] represents the current loop KP parameter, 0x55 decimal represents 85, assuming that the maximum current loop set by the system is 3, then the actual value of 1 unit is 3/256 = 0.01171875, and 85 units represent the actual value of 85\* 0.01171875 = 0.99609375, which is the actual value of the KP parameter of the current loop inside the system.

Data[3] represents the current loop KI parameter, 0x19 decimal represents 25, assuming that the maximum value of the current loop set by the system is 0.1, then the actual value of 1 unit is 0.1/256 = 0.00039062, and 25 units represent the actual value of 25\* 0.00039062 = 0.0097656, which is the actual value of the KI parameter of the current loop inside the system.

Data[4] represents the KP parameter of the speed loop, and 0x55 in decimal represents 85. Assuming that the maximum value of the speed loop set by the system is 0.1, the actual value of 1 unit is 0.1/256 = 0.00039062, and 85 units represent the actual value of 85\* 0.00039062 = 0.0332027, this is the actual value of the KP parameter of the internal speed loop of the system.

Data[5] represents the speed loop KI parameter, 0x19 decimal represents 25, assuming that the maximum speed loop set by the system is 0.01, then the actual value of 1 unit is 0.01/256 = 0.00003906, and 25 units means the actual value is 25\* 0.00003906 = 0.0009765, this is the actual value of the KI parameter of the speed loop inside the system.

Data[6] represents the KP parameter of the position loop, 0x55 in decimal means 85, assuming that the maximum value of the position loop set by the system is 0.1, then the actual value of 1 unit is 0.1/256 = 0.00039062, and 85 units means the actual value is 85\* 0.00039062 = 0.0332027, this is the actual value of the KP parameter of the internal position loop of the system.

Data[7] represents the position loop KI parameter, 0x19 decimal represents 25, assuming that the maximum value of the position loop set by the system is 0.01, then the actual value of 1 unit is 0.01/256 = 0.00003906, and 25 units means the actual value is 25\* 0.00003906 = 0.0009765, which is the actual value of the KI parameter of the internal position loop of the system.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x31 | 0x00 | 0x55 | 0x19 | 0x55 | 0x19 | 0x55 | 0x19 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x31 | 0x00 | 0x55 | 0x19 | 0x55 | 0x19 | 0x55 | 0x19 | CRC16L | CRC16H |

**2.3. Write PID parameters to ROM command (0x32)**

**2.3.1. Instruction description**

This command can write the parameters of current, speed, position loop KP and KI to ROM at one time, which can be saved after power off. The data type is uint8\_t. The system sets the maximum range of PI parameters according to the motor model, and then divides it equally according to the maximum range of uint8\_t of 256 units. Users only need to adjust 0-256 units.

**2.3.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **Data Field** | **Description** | **Data** |
| DATA[0] | command byte | 0x32 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | Current loop KP parameters | DATA[2] = (uint8\_t)(CurrKP) |
| DATA[3] | Current loop KI parameters | DATA[3] = (uint8\_t)(CurrKI) |
| DATA[4] | Speed loop KP parameters | DATA[4] = (uint8\_t)(SpdKP) |
| DATA[5] | Speed loop KI parameters | DATA[5] = (uint8\_t)(SpdKI) |
| DATA[6] | Position loop KP parameters | DATA[6] = (uint8\_t)(PosKP) |
| DATA[7] | Position loop KI parameters | DATA[7] = (uint8\_t)(PosKI) |

**2.3.3. Reply data field definition**

The content of the reply data is the same as the sent data.

**2.3.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x32 | 0x00 | 0x55 | 0x19 | 0x55 | 0x19 | 0x55 | 0x19 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x32 | 0x00 | 0x55 | 0x19 | 0x55 | 0x19 | 0x55 | 0x19 | CRC16L | CRC16H |

**Description:**

Data[2] represents the current loop KP parameter, 0x55 decimal represents 85, assuming that the maximum value of the current loop set by the system is 3, then the actual value of 1 unit is 3/256 = 0.01171875, and 85 units represent the actual value 85\*0.01171875 = 0.99609375, which is the actual value of the KP parameter of the current loop inside the system.

Data[3] represents the current loop KI parameter, 0x19 decimal represents 25, assuming that the maximum value of the current loop set by the system is 0.1, then the actual value of 1 unit is 0.1/256 = 0.00039062, and 25 units represent the actual value of 25\* 0.00039062 = 0.0097656, which is the actual value of the KI parameter of the current loop inside the system.

Data[4] represents the KP parameter of the speed loop, and 0x55 in decimal represents 85. Assuming that the maximum value of the speed loop set by the system is 0.1, the actual value of 1 unit is 0.1/256 = 0.00039062, and 85 units represent the actual value of 85\* 0.00039062 = 0.0332027, this is the actual value of the KP parameter of the internal speed loop of the system.

Data[5] represents the speed loop KI parameter, 0x19 decimal represents 25, assuming that the maximum speed loop set by the system is 0.01, then the actual value of 1 unit is 0.01/256 = 0.00003906, and 25 units means the actual value is 25\* 0.00003906 = 0.0009765, this is the actual value of the KI parameter of the speed loop inside the system.

Data[6] represents the KP parameter of the position loop, 0x55 in decimal means 85, assuming that the maximum value of the position loop set by the system is 0.1, then the actual value of 1 unit is 0.1/256 = 0.00039062, and 85 units means the actual value is 85\* 0.00039062 = 0.0332027, this is the actual value of the KP parameter of the internal position loop of the system.

Data[7] represents the position loop KI parameter, 0x19 decimal represents 25, assuming that the maximum value of the position loop set by the system is 0.01, then the actual value of 1 unit is 0.01/256 = 0.00003906, and 25 units means the actual value is 25\* 0.00003906 = 0.0009765, which is the actual value of the KI parameter of the internal position loop of the system.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x32 | 0x00 | 0x55 | 0x19 | 0x55 | 0x19 | 0x55 | 0x19 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x32 | 0x00 | 0x55 | 0x19 | 0x55 | 0x19 | 0x55 | 0x19 | CRC16L | CRC16H |

**2.4. Read acceleration command (0x42)**

**2.4.1. Instruction description**

The host sends this command to read the acceleration parameters of the current motor

**2.4.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **Data** |
| DATA[0] | command byte | 0x42 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.4.3. Reply data field definition**

The acceleration parameter is included in the drive response data. Acceleration data Accel is int32\_t type, the unit is 1dps/s, and the parameter range is 50-60000.

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **Data** |
| DATA[0] | command byte | 0x42 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | Acceleration low byte 1 | DATA[4] = (uint8\_t)(Accel) |
| DATA[5] | acceleration byte 2 | DATA[5] = (uint8\_t)(Accel>>8) |
| DATA[6] | acceleration byte 3 | DATA[6] = (uint8\_t)(Accel>>16) |
| DATA[7] | acceleration byte 4 | DATA[7] = (uint8\_t)(Accel>>24) |

**2.4.4.** **Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x42 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x42 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. It means that the acceleration of the motor position loop is 10000dps/s.

**2.5. Write acceleration to RAM and ROM command (0x43)**

**2.5.1. Instruction description**

The host sends this command to write the acceleration and deceleration into RAM and ROM, which can be saved after power off. Acceleration data Accel is of uint32\_t type, the unit is 1dps/s, and the parameter range is 100-60000. The command contains the acceleration and deceleration values in the position and velocity planning, which are determined by the index value. For details, see the index description table in 2.5.4.

**2.5.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x43 |
| DATA[1] | function inde | DATA[1] = (uint8\_t)index |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | Acceleration low byte 1 | DATA[4] = (uint8\_t)(Accel) |
| DATA[5] | acceleration byte 2 | DATA[5] = (uint8\_t)(Accel>>8) |
| DATA[6] | acceleration byte 3 | DATA[6] = (uint8\_t)(Accel>>16) |
| DATA[7] | acceleration byte 4 | DATA[7] = (uint8\_t)(Accel>>24) |

**2.5.3. Reply data field definition**

The motor will reply to the host after receiving the command, and the reply command is the same as the received command.

**2.5.4. Function Index Description**

|  |  |  |
| --- | --- | --- |
| **Index value** | **Command name** | **Function description** |
| 0x00 | position planning acceleration | Acceleration value from initial velocity to maximum velocity in position planning |
| 0x01 | Position planning deceleration | Deceleration value from maximum speed to stop in position planning |
| 0x02 | speed planning acceleration | The acceleration value from the current speed to the target speed, including the acceleration in the forward and reverse directions |
| 0x03 | speed planning deceleration | In the same direction, the deceleration value from the current speed to the target speed |

**2.5.5 Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x43 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x43 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[1] is 0x00, indicating the position planning acceleration value. Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. Indicates that the position planning acceleration of 10000dps/s is written to the motor driver, and the value can be saved after the power is turned off.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x43 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x43 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**The motor replies to the host after receiving the command, and the reply command is the same as the received command.

**Example 2:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID号 | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x43 | 0x01 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 帧头 | ID号 | 长度 | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x43 | 0x01 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** Data[1] is 0x01, indicating the deceleration value of position planning. Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. Indicates that the position planning deceleration of 10000dps/s is written to the motor driver, and the value can be saved after the power is turned off.

**Reply command:**

CAN:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID号 | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x43 | 0x01 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

RS485:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 帧头 | ID号 | 长度 | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x43 | 0x01 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** The motor replies to the host computer after receiving the command, and the reply command is the same as the received command.

**Example 3:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID号 | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x43 | 0x02 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 帧头 | ID号 | 长度 | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x43 | 0x02 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** Data[1] is 0x02, which indicates the acceleration value of speed planning. Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. Indicates that the speed planning acceleration of 10000dps/s is written to the motor driver, and the value can be saved after power off.

**Reply command:**

CAN:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID号 | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x43 | 0x02 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

RS485:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 帧头 | ID号 | 长度 | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x43 | 0x02 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** The motor replies to the host after receiving the command, and the reply command is the same as the received command.

**Example 4:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID号 | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x43 | 0x03 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 帧头 | ID号 | 长度 | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x43 | 0x03 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** Data[1] is 0x03, indicating the speed planning deceleration value. Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. Indicates that the speed planning deceleration of 10000dps/s is written to the motor driver, and the value can be saved after the power is turned off.

**Reply command:**

CAN:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID号 | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x43 | 0x03 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

RS485:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 帧头 | ID号 | 长度 | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x43 | 0x03 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** The motor replies to the host after receiving the command, and the reply command is the same as the received command.

**2.6. Read multi-turn encoder position data command (0x60)**

**2.6.1. Instruction description**

The host sends this command to read the multi-turn position of the encoder, which represents the rotation angle of the motor output shaft, including the multi-turn angle.

**2.6.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x60 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.6.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters. Encoder multi-turn position encoder (int32\_t type, value range of multi-turn encoder, 4 bytes of valid data), which is the value after subtracting the encoder's multi-turn zero offset (initial position) from the original position of the encoder.

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x60 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | Encoder position low byte 1 | DATA[4] = (uint8\_t)(encoder) |
| DATA[5] | encoder position byte 2 | DATA[5] = (uint8\_t)(encoder>>8) |
| DATA[6] | encoder position byte 3 | DATA[6] = (uint8\_t)(encoder>>16) |
| DATA[7] | encoder position byte 4 | DATA[7] = (uint8\_t)(encoder>>24) |

**2.6.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x60 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x60 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** The host sends this command to read the multi-turn position of the encoder.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x60 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x60 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. The multi-turn encoder value representing the current relative multi-turn zero offset (initial position) of the motor is 10000 pulses.

**2.7. Read multi-turn encoder original position data command (0x61)**

**2.7.1. Instruction description**

The host sends this command to read the multi-turn encoder home position, ie the multi-turn encoder value without the zero offset (home position).

**2.7.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x61 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.7.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters. Encoder multi-turn raw position encoderRaw (int32\_t type, value range, valid data 4 bytes).

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x61 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | Encoder original position byte1 | DATA[4] = (uint8\_t)(encoderRaw) |
| DATA[5] | Encoder original position byte 2 | DATA[5] = (uint8\_t)(encoderRaw>>8) |
| DATA[6] | Encoder original position byte3 | DATA[6] = (uint8\_t)(encoderRaw>>16) |
| DATA[7] | Encoder original position byte4 | DATA[7] = (uint8\_t)(encoderRaw>>24) |

**2.7.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x61 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x61 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

The host sends this command to read the original position of the encoder multi-turn.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x61 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x61 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. Indicates that the current multi-turn encoder value of the motor is 10000 pulses, excluding the zero offset (initial position).

**2.8. Read multi-turn encoder zero offset data command (0x62)**

**2.8.1. Instruction description**

The host sends this command to read the multi-turn zero offset value (initial position) of the encoder.

**2.8.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x62 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.8.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters. Encoder multi-turn zero offset encoderOffset (int32\_t type, value range, valid data 4 bytes).

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x62 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | Encoder Offset Byte 1 | DATA[4] = (uint8\_t)(encoderOffset) |
| DATA[5] | Encoder Offset Byte2 | DATA[5] = (uint8\_t)(encoderOffset>>8) |
| DATA[6] | Encoder Offset Byte3 | DATA[6] = (uint8\_t)(encoderOffset>>16) |
| DATA[7] | Encoder Offset Byte4 | DATA[7] = (uint8\_t)(encoderOffset>>24) |

**2.8.4.** **Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x62 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x62 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

The host sends this command to read the multi-turn zero offset value of the encoder.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x62 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x62 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. Indicates that the current multi-turn encoder zero offset value of the motor is 10000 pulses.

**2.9. Write encoder multi-turn value to ROM as motor zero command (0x63)**

**2.9.1. Instruction description**

The host sends this command to set the zero offset (initial position) of the encoder, where the encoder multi-turn value to be written, encoderOffset, is of type int32\_t, (value range, 4 bytes of valid data).

Note: After writing the position of the new zero point, the motor needs to be restarted to be effective. Because of the change of the zero offset, the new zero offset (initial position) should be used as a reference when setting the target position.

**2.9.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x63 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | Encoder zero bias low byte 1 | DATA[4] = (uint8\_t)(encoderOffset) |
| DATA[5] | Encoder Offset Byte2 | DATA[5] = (uint8\_t)(encoderOffset>>8) |
| DATA[6] | Encoder Offset Byte3 | DATA[6] = (uint8\_t)(encoderOffset>>8) |
| DATA[7] | Encoder Offset Byte4 | DATA[7] = (uint8\_t)(encoderOffset>>8) |

**2.9.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data is the same as the command sent by the host.

**2.9.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x63 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x63 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. It means to write 10000 pulses as multi-turn encoder zero offset.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x63 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x63 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

The motor replies to the host after receiving the command, and the frame data is the same as the command sent by the host.

**2.10. Write the current multi-turn position of the encoder to the ROM as the motor zero command (0x64)**

**2.10.1. Instruction description**

Write the current encoder position of the motor as the multi-turn encoder zero offset (initial position) into the ROM

Note: After writing the new zero point position, the motor needs to be restarted to be effective. Because of the change of the zero offset, the new zero offset (initial position) should be used as a reference when setting the target position.

**2.10.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x64 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.10.3. Reply data field definition**

The motor replies to the host after receiving the command, and the encoderOffset in the data is the set zero offset value.

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x64 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | Encoder zero bias low byte1 | DATA[4] = (uint8\_t)(encoderOffset) |
| DATA[5] | Encoder Offset Byte2 | DATA[5] = (uint8\_t)(encoderOffset>>8) |
| DATA[6] | Encoder Offset Byte3 | DATA[6] = (uint8\_t)(encoderOffset>>16) |
| DATA[7] | Encoder Offset Byte4 | DATA[7] = (uint8\_t)(encoderOffset>>24) |

**2.10.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x64 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x64 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

After sending the 0x64 command, the motor will write the current multi-turn encoder value as the zero offset (initial position) into the ROM.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x64 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x64 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. Indicates that the multi-turn zero offset value (initial position) written to the motor is 10,000 pulses.

**2.11. Read single-turn encoder command (0x90)**

**2.11.1. Instruction Description**

The host sends this command to read the current position of the encoder. Note that the current command is used as a single-turn data reading command for direct drive motors.

**2.11.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **Data Field** | **Description** | **Data** |
| DATA[0] | 命令字节 | 0x90 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.11.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters.

1. The encoder position encoder is the original position of the encoder minus the zero offset of the encoder.

2. The original encoder position encoderRaw.

3. Encoder zero offset encoderOffset, this point is used as the zero point of the motor angle.

|  |  |  |
| --- | --- | --- |
| **Data Field** | **Description** | **Data** |
| DATA[0] | Command byte | 0x90 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | Encoder position low byte | DATA[1] = (uint8\_t)(encoder) |
| DATA[3] | Encoder position high byte | DATA[2] = (uint8\_t)(encoder>>8) |
| DATA[4] | Encoder original position low byte | DATA[3] = (uint8\_t)(encoderRaw) |
| DATA[5] | Encoder original position high byte | DATA[4] = (uint8\_t)(encoderRaw>>8) |
| DATA[6] | Encoder zero bias low byte | DATA[5] = (uint8\_t)(encoderOffset) |
| DATA[7] | Encoder zero bias high byte | DATA[6] = (uint8\_t)(encoderOffset>>8) |

**2.11.4. Example of communication**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x90 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x90 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Note:** After sending the 0x90 command, it will return the motor single-turn encoder value.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x90 | 0x00 | 0x33 | 0x08 | 0xBE | 0x2C | 0x8B | 0x24 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x90 | 0x00 | 0x33 | 0x08 | 0xBE | 0x2C | 0x8B | 0x24 | CRC16L | CRC16H |

**Explanation:** Data[2] to data[3] form a (Data[2] is the lowest bit, Data[3] is the highest bit) 16-bit data is 0x0833, which means the decimal system is 2099, which means the current relative zero offset encoder of the motor The position is 2099 pulses. Data[4] to data[5] make up a (Data[4] is the lowest bit, Data[5] is the highest bit) 16-bit data is 0x2CBE, which means that the decimal system is 11454, which means that the current encoder original position of the motor is 11454 pulse. Data[6] to data[7] form a (Data[6] is the lowest bit, Data[7] is the highest bit) 16-bit data is 0x248B, which means that the decimal system is 9355, which means that the zero offset position of the motor is 9355 pulses.

**2.12. Read multi-turn angle command (0x92)**

**2.12.1. Instruction description**

The host sends this command to read the current multi-turn absolute angle value of the motor.

**2.12.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x92 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.12.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters.

1. Motor angle motorAngle, (int32\_t type, value range, valid data 4 bytes), unit 0.01°/LSB.

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x92 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | angle low byte 1 | DATA[4] = (uint8\_t)(motorAngle) |
| DATA[5] | angle bytes2 | DATA[5] = (uint8\_t)(motorAngle>>8) |
| DATA[6] | angle bytes3 | DATA[6] = (uint8\_t)(motorAngle>>16) |
| DATA[7] | angle bytes4 | DATA[7] = (uint8\_t)(motorAngle>>24) |

**2.12.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x92 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x92 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

After sending the 0x92 command, it will return the absolute angle of the motor output shaft.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x92 | 0x00 | 0x00 | 0x00 | 0xA0 | 0x8C | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x92 | 0x00 | 0x00 | 0x00 | 0xA0 | 0x8C | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) The 32-bit data is 0x00008CA0, which means the decimal is 36000, which is reduced by 100 times in units of 0.01°/LSB That is 36000\*0.01=360°. Indicates that the motor output shaft moves 360° in the positive direction relative to the zero position.

**2.13. Read single-turn angle command (0x94)**

**2.13.1. Instruction Description**

The host sends this command to read the current single-turn angle of the motor. Note that the current command is used as a single-turn data read command for direct drive motors.

**2.13.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **Data Field** | **Description** | **Data** |
| DATA[0] | 命令字节 | 0x94 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.13.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters.

1. The single circle angle of the motor, circleAngle, is int16\_t type data. It starts from the zero point of the encoder and increases clockwise. When it reaches the zero point again, the value returns to 0. The unit is 0.01°/LSB, and the value ranges from 0 to 35999.

|  |  |  |
| --- | --- | --- |
| **Data field** | **Description** | **Data** |
| DATA[0] | Command byte | 0x94 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | Single turn angle low byte | DATA[5] = (uint8\_t)(circleAngle) |
| DATA[7] | Single turn angle high byte | DATA[6] = (uint8\_t)(circleAngle>>8) |

**2.13.4. Example of communication**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x94 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x94 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Note:** After sending the 0x94 command, it will return the motor single-turn angle.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x94 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x94 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | CRC16L | CRC16H |

**Explanation:**

Data[6] to data[7] form a (Data[6] is the lowest bit, Data[7] is the highest bit) 16-bit data is 0x2710, indicating that the decimal system is 10000, and the unit is 0.01°. Indicates that the motor is currently at 100° relative to the zero position.

**2.14. Read Motor Status 1 and Error Flag Command (0x9A)**

**2.14.1. Instruction description**

This command reads the current motor temperature, voltage and error status flags

**2.14.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x9A |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.14.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters:

1. Motor temperature temperature (int8\_t type, unit 1℃/LSB).

2. Brake control command: Indicates the state of the brake control command, 1 represents the brake release command, and 0 represents the brake lock command.

2. Voltage (uint16\_t type, unit 0.1V/LSB).

3. Error flag errorState (of type uint16\_t, each bit represents a different motor state)

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x9A |
| DATA[1] | Motor temperature | DATA[1] = (uint8\_t)(temperature) |
| DATA[2] | NULL | 0x00 |
| DATA[3] | Brake release command | DATA[3] = (uint8\_t)(RlyCtrlRslt) |
| DATA[4] | voltage low byte | DATA[4] = (uint8\_t)(voltage) |
| DATA[5] | voltage high byte | DATA[5] = (uint8\_t)(voltage>>8) |
| DATA[6] | Error Status Low Byte 1 | DATA[6] = (uint8\_t)(errorState) |
| DATA[7] | error status byte 2 | DATA[7] = (uint8\_t)(errorState>>8) |

**Remark:**

1. System abnormal state value System\_errorState state table 1 is as follows:

|  |  |
| --- | --- |
| **System\_errorState** | **Status Description** |
| 0x0002 | Motor stall |
| 0x0004 | low pressure |
| 0x0008 | overvoltage |
| 0x0010 | overcurrent |
| 0x0040 | Power overrun |
| 0x0100 | speeding |
| 0x0200 |  |
| 0x0400 |  |
| 0x0800 |  |
| 0x1000 | Motor temperature over temperature |
| 0x2000 | Encoder calibration error |

**2.14.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x9A | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x9A | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

After sending the 0x9A command, the temperature, voltage and error status flags of the motor will be returned.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x9A | 0x32 | 0x00 | 0x01 | 0xE5 | 0x01 | 0x04 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x9A | 0x32 | 0x00 | 0x01 | 0xE5 | 0x01 | 0x04 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment.

Data[3] indicates that the brake indicates the state of the brake control command, 1 represents the brake release command, and 0 represents the brake lock command. So 0x01 indicates that the current brake release command has been executed.

Data[4] and Data[5] (Data[4] is the low bit, Data[5] is the high bit) form 0x01E5, the decimal is 485, which is reduced by 10 times according to the unit of 0.1V/LSB, 485\*0.1=48.5V, representing The current motor supply voltage is 48.5V.

Data[6] and Data[7] (Data[6] is low and Data[7] is high) form 0x0004, which indicates a low-voltage error according to the error description in the System\_errorState table.

**2.15. Read Motor Status 2 Command (0x9C)**

**2.15.1. Instruction description**

This command reads the temperature, speed and encoder position of the current motor.

**2.15.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x9C |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.15.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters.

1. Motor temperature temperature (int8\_t type, 1℃/LSB).

2. The torque current value iq of the motor (int16\_t type, 0.01A/LSB).

3. Motor output shaft speed (int16\_t type, 1dps/LSB).

4. Motor output shaft angle (int16\_t type, 1degree/LSB, maximum range ±32767degree).

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x9C |
| DATA[1] | Motor temperature | DATA[1] = (uint8\_t)(temperature) |
| DATA[2] | Torque current low byte | DATA[2] = (uint8\_t)(iq) |
| DATA[3] | Torque current high byte | DATA[3] = (uint8\_t)(iq>>8) |
| DATA[4] | Motor speed low byte | DATA[4] = (uint8\_t)(speed) |
| DATA[5] | Motor speed high byte | DATA[5] = (uint8\_t)(speed>>8) |
| DATA[6] | Motor angle low byte | DATA[6] = (uint8\_t)(degree) |
| DATA[7] | Motor angle high byte | DATA[7] = (uint8\_t)(degree>>8) |

**2.15.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x9C | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x9C | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

This command reads the current temperature, speed and encoder position of the motor.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x9C | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0x2D | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x9C | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0x2D | 0x00 | CRC16L | CRC16H |

**Description:**

Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data of Data[2] and Data[3] 0x0064 is 100 in decimal, and it is 100\*0.01=1A when scaled down by 100 times, which means that the actual current of the current motor is 1A. The composite data 0x01F4 of Data[4] and Data[5] is 500 in decimal, which means the motor output shaft speed is 500dps. There is a reduction ratio relationship between the motor output shaft speed and the motor speed. If the reduction ratio is 6, then the motor speed is 6 times higher than the output shaft speed. The composite data of Data[6] and Data[7] 0x002D is 45 in decimal, which means that the motor output shaft moves 45 degrees in the positive direction relative to the zero position. The position of the motor output shaft is related to the number of lines of the motor encoder and the reduction ratio. For example, if the number of lines of the motor encoder is 65536 and the reduction ratio is 6, then 360 degrees of the motor output shaft corresponds to 65536\*6 = 393216 pulses.

**2.16. Read Motor Status 3 Command (0x9D)**

**2.16.1. Instruction description**

This command reads the current motor temperature and phase current data

**2.16.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x9D |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.16.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following data:

1. Motor temperature temperature (int8\_t type, 1℃/LSB)

2. Phase A current data, the data type is int16\_t, and the corresponding actual phase current is 0.01ALSB.

3.B-phase current data, the data type is int16\_t type, and the corresponding actual phase current is 0.01ALSB.

4. C-phase current data, the data type is int16\_t type, and the corresponding actual phase current is 0.01ALSB.

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x9D |
| DATA[1] | Motor temperature | DATA[1] = (uint8\_t)(temperature) |
| DATA[2] | Phase A current low byte | DATA[2] = (uint8\_t)(iA) |
| DATA[3] | Phase A current high byte | DATA[3] = (uint8\_t)(iA>>8) |
| DATA[4] | Phase B current low byte | DATA[4] = (uint8\_t)(iB) |
| DATA[5] | Phase B current high byte | DATA[5] = (uint8\_t)(iB>>8) |
| DATA[6] | Phase C current low byte | DATA[6] = (uint8\_t)(iC) |
| DATA[7] | Phase C current high byte | DATA[7] = (uint8\_t)(iC>>8) |

**2.16.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x9D | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x9D | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

This command reads the current motor temperature and phase current data.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x9D | 0x32 | 0xC2 | 0x0B | 0x10 | 0xFA | 0xC0 | 0xF9 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x9D | 0x32 | 0xC2 | 0x0B | 0x10 | 0xFA | 0xC0 | 0xF9 | CRC16L | CRC16H |

**Description:**

Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data 0x0BC2 of Data[2] and Data[3] is 3010 in decimal, and it is 3010\*0.01=30.1A when scaled down by 100 times, which means that the actual current of the current phase A of the motor is 30.1A. The composite data 0xFA10 of Data[4] and Data[5] is -1520 in decimal, and it is -1520\*0.01=-15.2A when scaled down by 100 times, which means that the actual current of the current phase B of the motor is -15.2A. The composite data 0xF9C0 of Data[6] and Data[7] is -1600 in decimal, and it is -1600\*0.01=-16A when scaled down by 100 times, which means that the actual current of the current phase C of the motor is -16A.

**2.17. Motor shutdown command (0x80)**

**2.17.1. Instruction description**

Turns off the motor output and also clears the motor running state, not in any closed loop mode.

**2.17.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x80 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.17.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data is the same as that sent by the host.

**2.17.4. Communication example**

**2.18. Motor stop command (0x81)**

**2.18.1. Instruction description**

Stop the motor, the closed-loop mode where the motor is still running, just stop the motor speed.

**2.18.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x81 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.18.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data is the same as that sent by the host

**2.18.4. Communication example**

**2.19. Torque closed-loop control command (0xA1)**

**2.19.1. Instruction description**

This command is a control command, which can be run when the motor is not faulty. The host sends this command to control the torque and current output of the motor. The control value iqControl is of type int16\_t and the unit is 0.01A/LSB.

**2.19.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0xA1 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | Torque current control value low byte | DATA[4] = (uint8\_t )(iqControl) |
| DATA[5] | Torque current control value high byte | DATA[5] = (uint8\_t )(iqControl>>8) |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.19.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters.

5. Motor temperature temperature (int8\_t type, 1℃/LSB).

6. The torque current value iq of the motor (int16\_t type, 0.01A/LSB).

7. Motor output shaft speed (int16\_t type, 1dps/LSB).

8. Motor output shaft angle (int16\_t type, 1degree/LSB, maximum range ±32767degree).

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0xA1 |
| DATA[1] | Motor temperature | DATA[1] = (uint8\_t)(temperature) |
| DATA[2] | Torque current low byte | DATA[2] = (uint8\_t)(iq) |
| DATA[3] | Torque current high byte | DATA[3] = (uint8\_t)(iq>>8) |
| DATA[4] | Motor speed low byte | DATA[4] = (uint8\_t)(speed) |
| DATA[5] | Motor speed high byte | DATA[5] = (uint8\_t)(speed>>8) |
| DATA[6] | Motor angle low byte | DATA[6] = (uint8\_t)(degree) |
| DATA[7] | Motor angle high byte | DATA[7] = (uint8\_t)(degree>>8) |

**2.19.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xA1 | 0x00 | 0x00 | 0x00 | 0x64 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA1 | 0x00 | 0x00 | 0x00 | 0x64 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[4] and data[5] represent the data size, Data[4] (0x64) is the low bit, and Data[5] (0x00) is the high bit. So the actual data is 0x0064, which means decimal 100, which is 100\*0.01=1A when reduced by 0.01A/LSB. Driving will be performed with 1A as the target current.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xA1 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0x2D | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA1 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0x2D | 0x00 | CRC16L | CRC16H |

**Description:**

Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data of Data[2] and Data[3] 0x0064 is 100 in decimal, and it is 100\*0.01=1A when scaled down by 100 times, which means that the actual current of the current motor is 1A. The composite data 0x01F4 of Data[4] and Data[5] is 500 in decimal, which means the motor output shaft speed is 500dps. There is a reduction ratio relationship between the motor output shaft speed and the motor speed. If the reduction ratio is 6, then the motor speed is 6 times higher than the output shaft speed. The composite data of Data[6] and Data[7] 0x002D is 45 in decimal, which means that the motor output shaft moves 45 degrees in the positive direction relative to the zero position. The position of the motor output shaft is related to the number of lines of the motor encoder and the reduction ratio. For example, if the number of lines of the motor encoder is 65536 and the reduction ratio is 6, then 360 degrees of the motor output shaft corresponds to 65536\*6 = 393216 pulses.

**Example 2:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xA1 | 0x00 | 0x00 | 0x00 | 0x9C | 0xFF | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA1 | 0x00 | 0x00 | 0x00 | 0x9C | 0xFF | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[4] and data[5] represent the data size, Data[4] (0x9C) is the low bit, Data[5] (0xFF) is the high bit. So the actual data is 0xFF9C, which means decimal -100, which is -100\*0.01=-1A when reduced by 0.01A/LSB. The drive will be performed with -1A as the target current.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xA1 | 0x32 | 0x9C | 0xFF | 0x0C | 0xFE | 0xD3 | 0xFF |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA1 | 0x32 | 0x9C | 0xFF | 0x0C | 0xFE | 0xD3 | 0xFF | CRC16L | CRC16H |

**Description:**

Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data of Data[2] and Data[3] 0xFF9C is -100 in decimal, and it is -100\*0.01=-1A when scaled down by 100 times, which means that the actual current of the current motor is -1A. The composite data 0xFE0C of Data[4] and Data[5] is -500 in decimal, which means the motor output shaft speed is -500dps. There is a reduction ratio relationship between the motor output shaft speed and the motor speed. If the reduction ratio is 6, then the motor speed is 6 times higher than the output shaft speed. The composite data of Data[6] and Data[7] 0xFFD3 is -45 in decimal, which means that the motor output shaft moves in the opposite direction by -45 degrees relative to the zero position. The position of the motor output shaft is related to the number of motor encoder lines and the reduction ratio. For example, if the number of motor encoder lines is 65536 and the reduction ratio is 6, then 360 degrees of the motor output shaft corresponds to 65536\*6 = 393216 pulses.

**2.20. Speed Closed-loop Control Command (0xA2)**

**2.20.1. Instruction description**

This command is a control command, which can be run when the motor is not faulty. The host sends this command to control the speed of the motor output shaft. The control value speedControl is int32\_t type, and the corresponding actual speed is 0.01dps/LSB.

**2.20.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0xA2 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | speed control low byte | DATA[4] = (uint8\_t)(speedControl) |
| DATA[5] | speed control | DATA[5] = (uint8\_t)(speedControl>>8) |
| DATA[6] | speed control | DATA[6] = (uint8\_t)(speedControl>>16) |
| DATA[7] | speed control high byte | DATA[7] = (uint8\_t)(speedControl>>24) |

**Remark:**

1. The maximum torque current of the motor under this command is limited by the Max Torque Current value in the host computer.

2. In this control mode, the maximum acceleration of the motor is limited by the Max Acceleration value in the host computer.

**2.20.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters.

1. Motor temperature temperature (int8\_t type, 1℃/LSB).

2. The torque current value iq of the motor (int16\_t type, 0.01A/LSB).

3. Motor output shaft speed (int16\_t type, 1dps/LSB).

4. Motor output shaft angle (int16\_t type, 1degree/LSB, maximum range ±32767degree).

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0xA2 |
| DATA[1] | Motor temperature | DATA[1] = (uint8\_t)(temperature) |
| DATA[2] | Torque current low byte | DATA[2] = (uint8\_t)(iq) |
| DATA[3] | Torque current high byte | DATA[3] = (uint8\_t)(iq>>8) |
| DATA[4] | Motor speed low byte | DATA[4] = (uint8\_t)(speed) |
| DATA[5] | Motor speed high byte | DATA[5] = (uint8\_t)(speed>>8) |
| DATA[6] | Motor angle low byte | DATA[6] = (uint8\_t)(degree) |
| DATA[7] | Motor angle high byte | DATA[7] = (uint8\_t)(degree>>8) |

**2.20.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xA2 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA2 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. The sending command is reduced by 100 times according to 0.01dps/LSB, that is, 10000\*0.01=100dps. The drive operates at the target speed of 100dps of the motor output shaft.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xA2 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0x2D | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA2 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0x2D | 0x00 | CRC16L | CRC16H |

**Description:**

Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data of Data[2] and Data[3] 0x0064 is 100 in decimal, and it is 100\*0.01=1A when scaled down by 100 times, which means that the actual current of the current motor is 1A. The composite data 0x01F4 of Data[4] and Data[5] is 500 in decimal, which means the motor output shaft speed is 500dps. There is a reduction ratio relationship between the motor output shaft speed and the motor speed. If the reduction ratio is 6, then the motor speed is 6 times higher than the output shaft speed. The composite data of Data[6] and Data[7] 0x002D is 45 in decimal, which means that the motor output shaft moves 45 degrees in the positive direction relative to the zero position. The position of the motor output shaft is related to the number of lines of the motor encoder and the reduction ratio. For example, if the number of lines of the motor encoder is 65536 and the reduction ratio is 6, then 360 degrees of the motor output shaft corresponds to 65536\*6 = 393216 pulses.

**Example 2:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xA2 | 0x00 | 0x00 | 0x00 | 0xF0 | 0xD8 | 0xFF | 0xFF |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA2 | 0x00 | 0x00 | 0x00 | 0xF0 | 0xD8 | 0xFF | 0xFF | CRC16L | CRC16H |

**Description:**

Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0xFFFFD8F0, which means -10000 in decimal. The sending command is reduced by 100 times according to 0.01dps/LSB, that is -10000\*0.01=-100dps. The drive runs at the target speed of the motor output shaft -100dps.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xA2 | 0x32 | 0x9C | 0xFF | 0x0C | 0xFE | 0xD3 | 0xFF |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA2 | 0x32 | 0x9C | 0xFF | 0x0C | 0xFE | 0xD3 | 0xFF | CRC16L | CRC16H |

**Description:**

Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data of Data[2] and Data[3] 0xFF9C is -100 in decimal, and it is -100\*0.01=-1A when scaled down by 100 times, which means that the actual current of the current motor is -1A. The composite data 0xFE0C of Data[4] and Data[5] is -500 in decimal, which means the motor output shaft speed is -500dps. There is a reduction ratio relationship between the motor output shaft speed and the motor speed. If the reduction ratio is 6, then the motor speed is 6 times higher than the output shaft speed. The composite data of Data[6] and Data[7] 0xFFD3 is -45 in decimal, which means that the motor output shaft moves in the opposite direction by -45 degrees relative to the zero position. The position of the motor output shaft is related to the number of motor encoder lines and the reduction ratio. For example, if the number of motor encoder lines is 65536 and the reduction ratio is 6, then 360 degrees of the motor output shaft corresponds to 65536\*6 = 393216 pulses.

**2.21. Absolute position closed-loop control command (0xA4)**

**2.21.1. Instruction description**

This command is a control command, which can be run when the motor is not faulty. The host sends this command to control the position of the motor (multi-turn angle). The control value angleControl is int32\_t type, and the corresponding actual position is 0.01degree/LSB, that is, 36000 represents 360°, and the rotation direction of the motor is determined by the difference between the target position and the current position . The control value maxSpeed limits the maximum speed of the motor output shaft rotation, which is of type uint16\_t, corresponding to the actual speed of 1dps/LSB.

**2.21.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **Data Field** | **Description** | **Data** |
| DATA[0] | Command byte | 0xA4 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | Speed limit low byte | DATA[2] = (uint8\_t)(maxSpeed) |
| DATA[3] | speed limit high byte | DATA[3] = (uint8\_t)(maxSpeed>>8) |
| DATA[4] | position control low byte | DATA[4] = (uint8\_t)(angleControl) |
| DATA[5] | position control | DATA[5] = (uint8\_t)(angleControl>>8) |
| DATA[6] | position control | DATA[6] = (uint8\_t)(angleControl>>16) |
| DATA[7] | position control high byte | DATA[7] = (uint8\_t)(angleControl>>24) |

**2.21.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters.

5. Motor temperature temperature (int8\_t type, 1℃/LSB).

6. The torque current value iq of the motor (int16\_t type, 0.01A/LSB).

7. Motor output shaft speed (int16\_t type, 1dps/LSB).

8. Motor output shaft angle (int16\_t type, 1degree/LSB, maximum range ±32767degree).

|  |  |  |
| --- | --- | --- |
| **Data Field** | **Description** | **Data** |
| DATA[0] | Command byte | 0xA4 |
| DATA[1] | Motor temperature | DATA[1] = (uint8\_t)(temperature) |
| DATA[2] | Torque current low byte | DATA[2] = (uint8\_t)(iq) |
| DATA[3] | Torque current high byte | DATA[3] = (uint8\_t)(iq>>8) |
| DATA[4] | Motor speed low byte | DATA[4] = (uint8\_t)(speed) |
| DATA[5] | Motor speed high byte | DATA[5] = (uint8\_t)(speed>>8) |
| DATA[6] | Motor angle low byte | DATA[6] = (uint8\_t)(degree) |
| DATA[7] | Motor angle high byte | DATA[7] = (uint8\_t)(degree>>8) |

**2.21.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xA4 | 0x00 | 0xF4 | 0x01 | 0xA0 | 0x8C | 0x00 | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA4 | 0x00 | 0xF4 | 0x01 | 0xA0 | 0x8C | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** Data[2] and Data[3] form one (Data[2] is the low bit, Data[3] is the high bit) 16-bit data is 0x01F4, which means the decimal 500dps motor output shaft speed. The drive will run the position loop at this speed as the maximum speed. Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00008CA0, which means 36000 in decimal. The sending command is reduced by 100 times according to 0.01degree/LSB, that is, 36000\*0.01=360°. The motor will move 360° in the positive direction with the output shaft relative to the zero position.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xA4 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0x2D | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA4 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0x2D | 0x00 | CRC16L | CRC16H |

**Description:** Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data of Data[2] and Data[3] 0x0064 is 100 in decimal, and it is 100\*0.01=1A when scaled down by 100 times, which means that the actual current of the current motor is 1A. The composite data 0x01F4 of Data[4] and Data[5] is 500 in decimal, which means the motor output shaft speed is 500dps. There is a reduction ratio relationship between the motor output shaft speed and the motor speed. If the reduction ratio is 6, then the motor speed is 6 times higher than the output shaft speed. The composite data of Data[6] and Data[7] 0x002D is 45 in decimal, which means that the motor output shaft moves 45 degrees in the positive direction relative to the zero position. The position of the motor output shaft is related to the number of motor encoder lines and the reduction ratio. For example, if the number of motor encoder lines is 16384 and the reduction ratio is 6, then 360 degrees of the motor output shaft corresponds to 16384\*6 = 98304 pulses.

**Example 2:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xA4 | 0x00 | 0xF4 | 0x01 | 0x60 | 0x73 | 0xFF | 0xFF |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA4 | 0x00 | 0xF4 | 0x01 | 0x60 | 0x73 | 0xFF | 0xFF | CRC16L | CRC16H |

**Description:** Data[2] and Data[3] form one (Data[2] is low, Data[3] is high) 16-bit data is 0x01F4, indicating decimal Control 500dps motor output shaft speed. The drive will run the position loop at this speed as the maximum speed. Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0xFFFF7360, which means -36000 in decimal. The sending command is reduced by 100 times according to 0.01degree/LSB, ie -36000\*0.01=-360°. The motor will move -360° in the opposite direction with the output shaft relative to the zero position.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xA4 | 0x32 | 0x9C | 0xFF | 0x0C | 0xFE | 0xD3 | 0xFF |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA4 | 0x32 | 0x9C | 0xFF | 0x0C | 0xFE | 0xD3 | 0xFF | CRC16L | CRC16H |

**Description:** Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data of Data[2] and Data[3] 0xFF9C is -100 in decimal, and it is -100\*0.01=-1A when scaled down by 100 times, which means that the actual current of the current motor is -1A. The composite data 0xFE0C of Data[4] and Data[5] is -500 in decimal, which means the motor output shaft speed is -500dps. There is a reduction ratio relationship between the motor output shaft speed and the motor speed. If the reduction ratio is 6, then the motor speed is 6 times higher than the output shaft speed. The composite data of Data[6] and Data[7] 0xFFD3 is -45 in decimal, which means that the motor output shaft moves in the opposite direction by -45 degrees relative to the zero position. The position of the motor output shaft is related to the number of motor encoder lines and the reduction ratio. For example, if the number of motor encoder lines is 16384 and the reduction ratio is 6, then 360 degrees of the motor output shaft corresponds to 16384\*6 = 98304 pulses.

**2.22. Single-turn position control command (0xA6)**

**2.22.1. Instruction Description**

The host sends this command to control the position of the motor (single-turn angle). When the multi-lap save function is turned off, the default is single-lap mode. This instruction can be used in single-turn mode.

1. The angle control value angleControl is of uint16\_t type, the value range is 0~35999, and the corresponding actual position is 0.01degree/LSB, that is, the actual angle range is 0°~359.99°.

2. spinDirection sets the direction of motor rotation, which is uint8\_t type, 0x00 means clockwise, and 0x01 means counterclockwise.

3. maxSpeed limits the maximum speed of motor rotation, which is of uint16\_t type, corresponding to the actual speed of 1dps/LSB.

**2.22.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **Data Field** | **Description** | **Data** |
| DATA[0] | Command byte | 0xA6 |
| DATA[1] | rotation direction byte | DATA[1] = spinDirection |
| DATA[2] | speed limit low byte | DATA[2] = (uint8\_t)(maxSpeed) |
| DATA[3] | speed limit high byte | DATA[3] = (uint8\_t)(maxSpeed>>8) |
| DATA[4] | Position Control Low Byte | DATA[4] = (uint8\_t)(angleControl) |
| DATA[5] | position control high byte | DATA[5] = (uint8\_t)(angleControl>>8) |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.22.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters.

5. Motor temperature temperature (int8\_t type, 1°C/LSB).

6. The torque current value iq of the motor (int16\_t type, 0.01A/LSB).

7. Motor output shaft speed (int16\_t type, 1dps/LSB).

8. Encoder position value encoder (uint16\_t type, the value range of the encoder is determined by the number of bits of the encoder).

|  |  |  |
| --- | --- | --- |
| **Data field** | **Description** | **Data** |
| DATA[0] | Command byte | 0xA6 |
| DATA[1] | motor temperature | DATA[1] = (uint8\_t)(temperature) |
| DATA[2] | Torque current low byte | DATA[2] = (uint8\_t)(iq) |
| DATA[3] | Torque Current High Byte | DATA[3] = (uint8\_t)(iq>>8) |
| DATA[4] | Motor Speed Low Byte | DATA[4] = (uint8\_t)(speed) |
| DATA[5] | Motor Speed High Byte | DATA[5] = (uint8\_t)(speed>>8) |
| DATA[6] | Encoder value low byte | DATA[6] = (uint8\_t)(encoder) |
| DATA[7] | Encoder value high byte | DATA[7] = (uint8\_t)(encoder>>8) |

**2.22.4. Example of communication**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xA6 | 0x00 | 0xF4 | 0x01 | 0xA0 | 0x8C | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA6 | 0x00 | 0xF4 | 0x01 | 0xA0 | 0x8C | 0x00 | 0x00 | CRC16L | CRC16H |

**Note:** Data[1] is 0, which means the motor will rotate clockwise. Data[2] and Data[3] form one (Data[2] is the low bit, Data[3] is the high bit) 16-bit data is 0x01F4, which means the decimal 500dps motor speed. The drive will run the position loop at this speed as the maximum speed. Data[4] to data[7] form a (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x8CA0, which means that the decimal system is 36000, and the unit is 0.01degree. The motor will move 360° clockwise. The 360-degree and 0-degree positions in the single-lap position coincide, so the position may also be 0 degrees at this time.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xA6 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0xE8 | 0x03 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA6 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0xE8 | 0x03 | CRC16L | CRC16H |

**Note:** Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data 0x0064 of Data[2] and Data[3] is 100 in decimal, which is 100\*0.01=1A according to the 100-fold reduction, which means that the actual current of the motor is 1A. Data[4] and Data[5] synthesized data 0x01F4 is 500 in decimal, which means the motor speed is 500dps. The synthetic data 0x03E8 of Data[6] and Data[7] is 1000 in decimal, which means that the value of the motor encoder relative to the zero position is 1000 pulses.

**Example 2:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xA6 | 0x01 | 0xF4 | 0x01 | 0xA0 | 0x8C | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA6 | 0x01 | 0xF4 | 0x01 | 0xA0 | 0x8C | 0x00 | 0x00 | CRC16L | CRC16H |

**Note:** Data[1] is 1, which means the motor will rotate counterclockwise. Data[2] and Data[3] form one (Data[2] is the low bit, Data[3] is the high bit) 16-bit data is 0x01F4, which means the decimal 500dps motor speed. The drive will run the position loop at this speed as the maximum speed. Data[4] to data[7] form a (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x8CA0, which means that the decimal system is 36000, and the unit is 0.01degree. The motor will move 360° in a counterclockwise direction. The 360-degree and 0-degree positions in the single-lap position coincide, so the position may also be 0 degrees at this time.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xA6 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0xE8 | 0x03 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA6 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0xE8 | 0x03 | CRC16L | CRC16H |

**Note:** Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data 0x0064 of Data[2] and Data[3] is 100 in decimal, which is 100\*0.01=1A according to the 100-fold reduction, which means that the actual current of the motor is 1A. Data[4] and Data[5] synthesized data 0x01F4 is 500 in decimal, which means the motor speed is 500dps. The synthetic data 0x03E8 of Data[6] and Data[7] is 1000 in decimal, which means that the value of the motor encoder relative to the zero position is 1000 pulses.

**2.23. Incremental position closed-loop control command (0xA8)**

**2.23.1. Instruction description**

This command is a control command, which can be run when the motor is not faulty. The host sends this command to control the incremental position (multi-turn angle) of the motor, and run the input position increment with the current position as the starting point. The control value angleControl is of type int32\_t, and the corresponding actual position is 0.01degree/LSB, that is, 36000 represents 360°, and the rotation direction of the motor is determined by the incremental position symbol.

The control value maxSpeed limits the maximum speed of the motor output shaft rotation, which is of type uint16\_t, corresponding to the actual speed of 1dps/LSB.

**2.23.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0xA8 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | speed limit low byte | DATA[2] = (uint8\_t)(maxSpeed) |
| DATA[3] | speed limit high byte | DATA[3] = (uint8\_t)(maxSpeed>>8) |
| DATA[4] | position control low byte | DATA[4] = (uint8\_t)(angleControl) |
| DATA[5] | position control | DATA[5] = (uint8\_t)(angleControl>>8) |
| DATA[6] | position control | DATA[6] = (uint8\_t)(angleControl>>16) |
| DATA[7] | position control high byte | DATA[7] = (uint8\_t)(angleControl>>24) |

**2.23.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data contains the following parameters.

5. Motor temperature temperature (int8\_t type, 1℃/LSB).

6. The torque current value iq of the motor (int16\_t type, 0.01A/LSB).

7. Motor output shaft speed (int16\_t type, 1dps/LSB).

8. Motor output shaft angle (int16\_t type, 1degree/LSB, maximum range ±32767degree).

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0xA8 |
| DATA[1] | Motor temperature | DATA[1] = (uint8\_t)(temperature) |
| DATA[2] | Torque current low byte | DATA[2] = (uint8\_t)(iq) |
| DATA[3] | Torque current high byte | DATA[3] = (uint8\_t)(iq>>8) |
| DATA[4] | Motor speed low byte | DATA[4] = (uint8\_t)(speed) |
| DATA[5] | Motor speed high byte | DATA[5] = (uint8\_t)(speed>>8) |
| DATA[6] | Motor angle low byte | DATA[6] = (uint8\_t)(degree) |
| DATA[7] | Motor angle high byte | DATA[7] = (uint8\_t)(degree>>8) |

**2.23.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xA8 | 0x00 | 0xF4 | 0x01 | 0xA0 | 0x8C | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA8 | 0x00 | 0xF4 | 0x01 | 0xA0 | 0x8C | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[2] and Data[3] form one (Data[2] is the low bit, Data[3] is the high bit) 16-bit data is 0x01F4, which means the decimal 500dps motor output shaft speed. The drive will run the position loop at this speed as the maximum speed. Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00008CA0, which means 36000 in decimal. The sending command is reduced by 100 times according to 0.01degree/LSB, that is, 36000\*0.01=360°. The motor will move 360° in the positive direction with the output shaft relative to the current position.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xA8 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0x2D | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA8 | 0x32 | 0x64 | 0x00 | 0xF4 | 0x01 | 0x2D | 0x00 | CRC16L | CRC16H |

**Description:**

Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data of Data[2] and Data[3] 0x0064 is 100 in decimal, and it is 100\*0.01=1A when scaled down by 100 times, which means that the actual current of the current motor is 1A. The composite data 0x01F4 of Data[4] and Data[5] is 500 in decimal, which means the motor output shaft speed is 500dps. There is a reduction ratio relationship between the motor output shaft speed and the motor speed. If the reduction ratio is 6, then the motor speed is 6 times higher than the output shaft speed. The composite data of Data[6] and Data[7] 0x002D is 45 in decimal, which means that the motor output shaft moves 45 degrees in the positive direction relative to the zero position. The position of the motor output shaft is related to the number of lines of the motor encoder and the reduction ratio. For example, if the number of lines of the motor encoder is 65536 and the reduction ratio is 6, then 360 degrees of the motor output shaft corresponds to 65536\*6 = 393216 pulses.

**Example 2:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xA8 | 0x00 | 0xF4 | 0x01 | 0x60 | 0x73 | 0xFF | 0xFF |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA8 | 0x00 | 0xF4 | 0x01 | 0x60 | 0x73 | 0xFF | 0xFF | CRC16L | CRC16H |

**Description:**

Data[2] and Data[3] form one (Data[2] is the low bit, Data[3] is the high bit) 16-bit data is 0x01F4, which means the decimal 500dps motor output shaft speed. The drive will run the position loop at this speed as the maximum speed. Data[4] to data[7] form one (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0xFFFF7360, which means -36000 in decimal. The sending command is reduced by 100 times according to 0.01degree/LSB, ie -36000\*0.01=-360°. The motor will move -360° in the opposite direction relative to the current position with the output shaft.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xA8 | 0x32 | 0x9C | 0xFF | 0x0C | 0xFE | 0xD3 | 0xFF |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xA8 | 0x32 | 0x9C | 0xFF | 0x0C | 0xFE | 0xD3 | 0xFF | CRC16L | CRC16H |

**Description:**

Data[1] = 0x32 is 50 in decimal, which means the motor temperature is 50 degrees at the moment. The composite data of Data[2] and Data[3] 0xFF9C is -100 in decimal, and it is -100\*0.01=-1A when scaled down by 100 times, which means that the actual current of the current motor is -1A. The composite data 0xFE0C of Data[4] and Data[5] is -500 in decimal, which means the motor output shaft speed is -500dps. There is a reduction ratio relationship between the motor output shaft speed and the motor speed. If the reduction ratio is 6, then the motor speed is 6 times higher than the output shaft speed. The composite data of Data[6] and Data[7] 0xFFD3 is -45 in decimal, which means that the motor output shaft moves in the opposite direction by -45 degrees relative to the zero position. The position of the motor output shaft is related to the number of lines of the motor encoder and the reduction ratio. For example, if the number of lines of the motor encoder is 65536 and the reduction ratio is 6, then 360 degrees of the motor output shaft corresponds to 65536\*6 = 393216 pulses.

**2.24. System operating mode acquisition (0x70)**

**2.24.1. Instruction description**

This command reads the current motor running mode.

**2.24.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x70 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.24.3. Reply data field definition**

The motor replies to the host after receiving the command, and the drive reply data contains the running state of the parameter runmode, which is of type uint8\_t.

The motor operation mode has the following 4 states:

1. Current loop mode (0x01).

2. Speed loop mode (0x02).

3. Position loop mode (0x03).

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x70 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | Motor operating mode | DATA[7] = (uint8\_t)(runmode) |

**2.24.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x70 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x70 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

This command reads the current motor running mode.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x70 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x03 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x70 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x03 | CRC16L | CRC16H |

**Description:**

Data[7] = 0x03, according to the definition of the reply frame, it means that the current system is in the position loop mode.

**2.25. Motor power acquisition (0x71)**

**2.25.1. Instruction description**

This command reads the current motor power.

**2.25.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x71 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.25.3. Reply data field definition**

The motor replies to the host after receiving the command, and the drive reply data contains the motor power parameter motorpower, which is of type uint16\_t, the unit is watt, and the unit is 0.1w/LSB.

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x71 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | Motor running power low byte | DATA[6] = (uint8\_t)(motorpower) |
| DATA[7] | Motor running power high byte | DATA[7] = (uint8\_t)(motorpower>>8) |

**2.25.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x71 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x71 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

This command reads the current motor power.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x71 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0xD0 | 0x07 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x71 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0xD0 | 0x07 | CRC16L | CRC16H |

**Description:**

The composition of Data[6] and Data[7] = 0x07D0, decimal 2000, reduced by 10 times according to the unit of 0.1W/LSB, 2000\*0.1=200W. Indicates that the current power of the motor is 200W.

**2.26. System reset command (0x76)**

**2.26.1. Instruction description**

This command is used to reset the system program.

**2.26.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x76 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.26.3. Reply data field definition**

The motor will reset after receiving the command and will not return to the command.

**2.26.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x76 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x76 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

After sending the command, the system is reset and the program runs again.

**2.27. System brake release command (0x77)**

**2.27.1. Instruction description**

This command is used to open the system brake. The system will release the holding brake, and the motor will be in a movable state without being restricted by the holding brake.

**2.27.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x77 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.27.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data is the same as the command sent by the host.

**2.27.4. Communication example**

**2.28. System brake lock command (0x78)**

**2.28.1. Instruction description**

This command is used to close the system holding brake. The holding brake locks the motor and the motor can no longer run. The holding brake is also in this state after the system is powered off.

**2.28.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x78 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.28.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data is the same as the command sent by the host.

**2.28.4. Communication example**

**2.29. System runtime read command (0xB1)**

**2.29.1. Instruction description**

This command is used to obtain the system running time in ms.

**2.29.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0xB1 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.29.3. Reply data field definition**

The motor replies to the host after receiving the command, and the drive reply data contains the system running time SysRunTime, which is uint32\_t type, and the unit is ms.

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0xB1 |
| DATA[0] | NULL | 0x00 |
| DATA[0] | NULL | 0x00 |
| DATA[0] | NULL | 0x00 |
| DATA[4] | SysRunTime low byte1 | DATA[4] = (uint8\_t)(SysRunTime) |
| DATA[5] | SysRunTime byte2 | DATA[5] = (uint8\_t)(SysRunTime>>8) |
| DATA[6] | SysRunTime byte3 | DATA[6] = (uint8\_t)(SysRunTime>>16) |
| DATA[7] | SysRunTime byte4 | DATA[7] = (uint8\_t)(SysRunTime>>24) |

**2.29.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xB1 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB1 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

This command reads the running time of the current system.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xB1 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x10 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB1 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x10 | CRC16L | CRC16H |

**Description:**

Data[4] to Data[7] (Data[4] is low and Data[7] is high) = 0x10000000, decimal 268435456, indicating that the system has run for 268435456ms after restarting or resetting, about 74 Hour.

**2.30. System software version date read command (0xB2)**

**2.30.1. Instruction description**

This command is used to get the update date of the system software version.

**2.30.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0xB2 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.30.3. Reply data field definition**

The motor will reply to the host after receiving the command. The driver reply data contains the latest version date of the system software, VersionDate, which is of type uint32\_t. The date format is in the format of year, month, and day, such as 20211126.

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0xB2 |
| DATA[0] | NULL | 0x00 |
| DATA[0] | NULL | 0x00 |
| DATA[0] | NULL | 0x00 |
| DATA[4] | VersionDate low byte1 | DATA[4] = (uint8\_t)(&VersionDate) |
| DATA[5] | VersionDate byte2 | DATA[5] = (uint8\_t)(VersionDate>>8) |
| DATA[6] | VersionDate byte3 | DATA[6] = (uint8\_t)(VersionDate>>16) |
| DATA[7] | VersionDate byte4 | DATA[7] = (uint8\_t)(VersionDate>>24) |

**2.30.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xB2 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB2 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

This command reads the current software version date.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xB2 | 0x00 | 0x00 | 0x00 | 0x2E | 0x89 | 0x34 | 0x01 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB2 | 0x00 | 0x00 | 0x00 | 0x2E | 0x89 | 0x34 | 0x01 | CRC16L | CRC16H |

**Description:**

Data[4] to Data[7] (Data[4] is low and Data[7] is high) = 0x0134892E, decimal 20220206, indicating that the software version date is February 6, 2022.

**2.31. Communication interruption protection time setting command (0xB3)**

**2.31.1. Instruction description**

This command is used to set the communication interruption protection time in ms. If the communication is interrupted for more than the set time, it will cut off the output brake lock. To run again, you need to establish stable and continuous communication first. Writing 0 means that the communication interruption protection function is not enabled.

**2.31.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0xB3 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | CanRecvTime\_MS low byte1 | DATA[4] = (uint8\_t)(CanRecvTime\_MS) |
| DATA[5] | CanRecvTime\_MS byte2 | DATA[5] = (uint8\_t)(CanRecvTime\_MS>>8) |
| DATA[6] | CanRecvTime\_MS byte3 | DATA[6] = (uint8\_t)(CanRecvTime\_MS>>16) |
| DATA[7] | CanRecvTime\_MS byte4 | DATA[7] = (uint8\_t)(CanRecvTime\_MS>>24) |

**2.31.3. Reply data field definition**

The motor replies to the host after receiving the command, and the frame data is the same as the command sent by the host.

**2.31.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xB3 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB3 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Note:**

The data values are all 0, which means that the communication interruption protection function is not enabled. If the communication is interrupted, the motor will continue to execute the current command.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xB3 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB3 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

The frame data is the same as the command sent by the host.

**Example 2:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xB3 | 0x00 | 0x00 | 0x00 | 0xE8 | 0x03 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB3 | 0x00 | 0x00 | 0x00 | 0xE8 | 0x03 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

Data[4] to Data[7] (Data[4] is low and Data[7] is high) constitute data 0x000003E8, decimal is 1000ms. Indicates that the communication interruption protection time is set to 1000ms, which is stored in the ROM and saved after power failure. Then, if the communication interval exceeds 1000ms, the communication interruption protection will be triggered, and the output lock brake will be cut off. When the communication interval is restored to within 1000ms, normal operation can be resumed.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xB3 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485：**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| frame header | ID | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB3 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:**

The frame data is the same as the command sent by the host.

**2.32. Communication baud rate setting command (0xB4)**

**2.32.1. Instruction description**

This instruction can set the communication baudrate of CAN and RS485 bus. The parameters will be saved in ROM after setting, and will be saved after power off, and will run at the modified baudrate when powered on again.

Baudrate:

RS485: 0 represents 115200bps baud rate,

1 stands for 500Kbps baud rate,

2 stands for 1Mbps baud rate,

3 represents 1.5Mbps baud rate,

4 represents 2Mbps baud rate;

CAN: 0 means 500Kbps baud rate,

1 stands for 1Mbps baud rate;

**2.32.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **Data Field** | **Description** | **Data** |
| DATA[0] | command byte | 0xB4 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | baudrate | DATA[7] = (uint8\_t)baudrate |

**2.32.3. Reply data field definition**

Since the communication baud rate is modified, the reply command is random and need not be processed.

**2.32.4. Communication example**

Example 1:

Send command:

CAN:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ID NO.** | **Data[0]** | **Data[1]** | **Data[2]** | **Data[3]** | **Data[4]** | **Data[5]** | **Data[6]** | **Data[7]** |
| 0x141 | 0xB4 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

RS485:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID NO. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB4 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L CRC16H |

Description: Data[7] = 0, which means the baud rate of RS485 is changed to 115200bps, and the baud rate of CAN is changed to 500Kbps.

Example 2:

Send command:

CAN:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ID NO.** | **Data[0]** | **Data[1]** | **Data[2]** | **Data[3]** | **Data[4]** | **Data[5]** | **Data[6]** | **Data[7]** |
| 0x141 | 0xB4 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x01 |

RS485:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID NO. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB4 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x01 | CRC16L CRC16H |

Description: Data[7] = 1, which means the RS485 baud rate is changed to 500Kbps, and the CAN baud rate is changed to 1Mbps.

Example 3:

Send command:

CAN:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **ID NO.** | **Data[0]** | **Data[1]** | **Data[2]** | **Data[3]** | **Data[4]** | **Data[5]** | **Data[6]** | **Data[7]** |
| 0x141 | 0xB4 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x02 |

RS485:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID NO. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB4 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x02 | CRC16L CRC16H |

Description: Data[7] = 2, which means the RS485 baud rate is changed to 1Mbps, and CAN is invalid.

**2.33. Motor model reading command (0xB5)**

**2.33.1. Instruction description**

This command is used to read the motor model, and the read data is ACSII code, which can be converted into the corresponding actual symbol by checking the ACSII code table.

**2.33.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **Data Field** | **Description** | **Data** |
| DATA[0] | 命令字节 | 0xB5 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | NULL | 0x00 |

**2.33.3. Reply data field definition**

|  |  |  |
| --- | --- | --- |
| **Data Field** | **Description** | **Data** |
| DATA[0] | Command byte | 0xB5 |
| DATA[1] | Motor model 1 | Type1(ACSII) |
| DATA[2] | Motor model 2 | Type2(ACSII) |
| DATA[3] | Motor model 3 | Type3(ACSII) |
| DATA[4] | Motor model 4 | Type4(ACSII) |
| DATA[5] | Motor model 5 | Type5(ACSII) |
| DATA[6] | Motor model 6 | Type6(ACSII) |
| DATA[7] | Motor model 7 | Type7(ACSII) |

**2.33.4. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0xB5 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB5 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** Send the command to read the motor model.

**Reply command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID No. | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0xB5 | 0x58 | 0x38 | 0x53 | 0x32 | 0x56 | 0x31 | 0x30 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0xB5 | 0x58 | 0x38 | 0x53 | 0x32 | 0x56 | 0x31 | 0x30 | CRC16L | CRC16H |

**Description:** This command replies with 7 ACSII codes, and the 7 characters corresponding to the motor model are obtained by looking up the table: RMD-X8 S2 V10.

**2.34. Function control command (0x20)**

**2.34.1. Instruction description**

This instruction is used to use some specific functions. It is a compound function instruction, which can contain multiple function control instructions.

**2.34.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **Data Field** | **Description** | **Data** |
| DATA[0] | command byte | 0x20 |
| DATA[1] | function index | DATA[1] = (uint8\_t)index |
| DATA[2] | NULL | 0x00 |
| DATA[3] | NULL | 0x00 |
| DATA[4] | Input parameter low byte 1 | DATA[4] = (uint8\_t)(Value) |
| DATA[5] | Input parameter low byte 2 | DATA[5] = (uint8\_t)(Value>>8) |
| DATA[6] | Input parameter low byte 3 | DATA[6] = (uint8\_t)(Value>>16) |
| DATA[7] | Input parameter low byte 4 | DATA[7] = (uint8\_t)(Value>>24) |

**2.34.3. Reply data field definition**

The motor replies to the host computer after receiving the command, and the frame data is the same as the command sent by the host computer.

**2.34.4. Function Index Description**

|  |  |  |
| --- | --- | --- |
| **Index value** | **Command name** | **Function description** |
| 0x01 | Clear multi-turn value | Clear motor multi-turn value, update zero point and save. It will take effect after restarting. |
| 0x02 | CANID filter Enable | The Value “1” means that the CANID filter is enabled, which can improve the efficiency of motor sending and receiving in CAN communication;  The Value “0” represents the disabled CANID filter, which needs to be disabled when the multi-motor control command 0x280 is required;  This value will be saved in FLASH, and the written value will be recorded after power off. |

**2.34.5. Communication example**

**Example 1:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID号 | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x20 | 0x01 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 帧头 | ID号 | 长度 | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x20 | 0x01 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** Data[1] = 0x01, according to the index value table, the representative function is to clear the multi-turn value.

**Command Reply:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID号 | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x20 | 0x01 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 帧头 | ID号 | 长度 | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x20 | 0x01 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** the frame data is the same as the command sent by the host.

**Example 2:**

**Send command:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID号 | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x141 | 0x20 | 0x02 | 0x00 | 0x00 | 0x01 | 0x00 | 0x00 | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 帧头 | ID号 | 长度 | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x20 | 0x02 | 0x00 | 0x00 | 0x01 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** Data[1] = 0x01, according to the index value table, the representative function is to enable the CANID filter. Note that the 0x280 multi-motor command cannot be used after enabling, and the CANID filter needs to be disabled before using the 0x280 command again.

**Command Reply:**

**CAN:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID号 | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x20 | 0x02 | 0x00 | 0x00 | 0x01 | 0x00 | 0x00 | 0x00 |

**RS485:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 帧头 | ID号 | 长度 | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x20 | 0x02 | 0x00 | 0x00 | 0x01 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** The frame data is the same as the command sent by the host computer.

**3. Multi-motor command (0x280 + command)**

**3.1. Instruction description**

The ID number is 280, which means that multiple motors correspond to the same command at the same time. The content and function of the instruction are the same as those of the single-motor instruction. For details, please refer to the single-motor instruction.

**3.2. Communication example**

Suppose there are 4 motors on the CAN bus, and the ID numbers are 141, 142, 143, and 144 respectively.

**Example 1:**

**Send command:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x280 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**Description:**

4 motors receive the 0x80 motor shutdown command at the same time (see 2.30 for details), and then all 4 motors immediately execute the motor shutdown command.

**Reply command:**

4 motors reply at the same time, and the reply ID is their own ID number respectively. The reply sequence depends on the respective delays on the bus.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**Description:**

The motor whose ID number is 0x241 returns the corresponding command.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x242 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**Description:**

The motor whose ID number is 0x242 returns the corresponding command.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x243 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**Description**:

The motor whose ID number is 0x243 returns the corresponding command.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x244 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**Description:**

The motor whose ID number is 0x244 returns the corresponding command.

**Example 2:**

**Send command:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x280 | 0x60 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**Description:**

4 motors receive the 0x60 read multi-turn encoder position data command at the same time (see 2.21 for details), and then the 4 motors reply to their respective multi-turn encoder position data.

Reply command:

4 motors reply at the same time, and the reply ID is their own ID number respectively. The reply sequence depends on the respective delays on the bus.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x241 | 0x60 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 |

**Description:**

The motor reply data with ID number 0x241 consists of Data[4] to data[7] (Data[4] is the lowest bit, Data[7] is the highest bit). The 32-bit data is 0x00002710, which means the decimal is 10000. The multi-turn encoder value representing the current relative multi-turn zero offset (initial position) of the motor is 10000 pulses.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x242 | 0x60 | 0x00 | 0x00 | 0x00 | 0x20 | 0x4E | 0x00 | 0x00 |

**Description:**

The motor reply data with ID number 0x242 consists of Data[4] to data[7] (Data[4] is the lowest bit, Data[7] is the highest bit). The 32-bit data is 0x00004E20, which means 20000 in decimal. The multi-turn encoder value representing the current relative multi-turn zero offset (initial position) of the motor is 20000 pulses.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x243 | 0x60 | 0x00 | 0x00 | 0x00 | 0x30 | 0x75 | 0x00 | 0x00 |

**Description**:

The motor reply data with ID number 0x243 consists of Data[4] to data[7] (Data[4] is the lowest bit, Data[7] is the highest bit). The 32-bit data is 0x00007530, which means 30000 in decimal. The multi-turn encoder value representing the current relative multi-turn zero offset (initial position) of the motor is 30000 pulses.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x244 | 0x60 | 0x00 | 0x00 | 0x00 | 0x40 | 0x9C | 0x00 | 0x00 |

**Description**:

The motor reply data with ID number 0x244 consists of Data[4] to data[7] (Data[4] is the lowest bit, Data[7] is the highest bit). The 32-bit data is 0x00009C40, which means 40000 in decimal. The multi-turn encoder value representing the current relative multi-turn zero offset (initial position) of the motor is 40000 pulses.

**4. CANID setting command (0x79)**

**4.1. Instruction description**

This command is used to set and read CAN ID.

The host sends this command to set and read the CAN ID, the parameters are as follows.

1. The read and write flag bit wReadWriteFlag is bool type, 1 read 0 write.

2. CANID, size range (#1~#32), uint16\_t type (synchronized with the upper computer function), device identifier 0x140 + ID (1~32).

**4.2. Send data field definition**

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x79 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | read and write flags | DATA[2] = wReadWriteFlag |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | CANID | DATA[7] = CANID(1~32) |

**4.3. Reply data field definition**

1. The motor replies to the host after receiving the command, which is divided into the following two situations:

2. Set CANID, the range is 1-32, and return to the original command.

3. Read CANID, the return parameters are as follows.

|  |  |  |
| --- | --- | --- |
| **data field** | **Description** | **data** |
| DATA[0] | command byte | 0x79 |
| DATA[0] | NULL | 0x00 |
| DATA[0] | read and write flags | DATA[2] = wReadWriteFlag |
| DATA[0] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | CANID low byte1 | DATA[6] = (uint8\_t \*)(CANID) |
| DATA[7] | CANID byte2 | DATA[7] = (uint8\_t)(CANID>>8) |

**4.4. Communication example**

**Example 1:**

**Send command:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x300 | 0x79 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x02 |

**Description:**

Data[2] = 0 means write CANID. Data[7] = 1 means that the motor CANID is set to 2, that is, the send ID is 0x142, and the reply ID is 0x242.

**Reply command:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x300 | 0x79 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x02 |

**Description:**

Same as sending command.

**Example 2:**

**Send command:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x300 | 0x79 | 0x00 | 0x01 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 |

**Description:**

Data[2] = 1 means reading CANID.

**Reply command:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Data[0] | Data[1] | Data[2] | Data[3] | Data[4] | Data[5] | Data[6] | Data[7] |
| 0x300 | 0x79 | 0x00 | 0x01 | 0x00 | 0x00 | 0x00 | 0x42 | 0x02 |

**Description:**

Data[6] and Data[7] form 0x242, which means that the motor send ID is 0x142, and the reply ID is 0x242.

1. **Motion Mode Control Command\_CAN (0x400 + ID)**

**5.1. Instruction Description**

The command consists of 5 input parameters:

p\_des (desired position),

v\_des(desired velocity),

t\_ff (feedforward torque),

kp (position deviation coefficient),

kd (speed deviation coefficient).

Each parameter has a preset range size:

p\_des: -12.5 to 12.5 in rad;

v\_des: -45 to 45, in rad/s;

t\_ff: -24 to 24, unit N-m;

kp: 0 to 500;

kd: 0 to 5;

Function expression: IqRef = [kp\*(p\_des - p\_fd\_actual position) + kd\*(v\_des - v\_fb\_actual speed) + t\_ff]\*KT\_torque coefficient; IqRef is the output current of the last given motor.

**5.2. Send data field definition**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Data field** | **Data partition** | **Data combination** | **Data definition** | **Data range** |
| DATA[0] | 0-3bit | p\_des[8-15] | p\_des Upper 8-bit data | 16-bit range |
| 4-7bit |
| DATA[1] | 0-3bit | p\_des[0-7] | p\_des Lower 8-bit data |
| 4-7bit |
| DATA[2] | 0-3bit | v\_des[4-11] | v\_des Upper 8-bit data | 12-bit range |
| 4-7bit |
| DATA[3] | 0-3bit | v\_des[0-3] | v\_des Lower 8-bit data |
| 4-7bit | kp[8-11] | kp Upper 4-bit data | 12-bit range |
| DATA[4] | 0-3bit | kp[0-7] | kp Lower 8-bit data |
| 4-7bit |
| DATA[5] | 0-3bit | kd[4-11] | kd Upper 8-bit data | 12-bit range |
| 4-7bit |
| DATA[6] | 0-3bit | kd[0-3] | kd Lower 4-bit data |
| 4-7bit | t\_ff[8-11] | t\_ff Upper 4-bit data | 12-bit range |
| DATA[7] | 0-3bit | t\_ff[0-7] | t\_ff Lower 8-bit data |
| 4-7bit |

**5.3. Reply data field definition**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Data field** | **Data partition** | **Data combination** | **Data definition** | **Data range** |
| DATA[0] | 0-3bit | p\_des[8-15] | p\_des Upper 8-bit data | 16-bit range |
| 4-7bit |
| DATA[1] | 0-3bit | p\_des[0-7] | p\_des Lower 8-bit data |
| 4-7bit |
| DATA[2] | 0-3bit | v\_des[4-11] | v\_des Upper 8-bit data | 12-bit range |
| 4-7bit |
| DATA[3] | 0-3bit | v\_des[0-3] | v\_des Lower 4-bit data |
| 4-7bit | kp[8-11] | t\_ff Upper 4-bit data | 12-bit range |
| DATA[4] | 0-3bit | t\_ff[0-7] | t\_ff Lower 8-bit data |
| 4-7bit |
| DATA[5] | 0-3bit | NULL | NULL | NULL |
| 4-7bit |
| DATA[6] | 0-3bit | NULL | NULL |
| 4-7bit | NULL | NULL | NULL |
| DATA[7] | 0-3bit | NULL | NULL |
| 4-7bit |

**5.4. Communication example**

Example 1:

Send command: ID number 0x401

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Data field** | **Data** | **Data partition** | | **Data definition** | **Data range** | **Data calculation instructions** |
| DATA[0] | 0xE6 | 0-3bit | 0xE | p\_des value is 0xE665 decimal is (58981) | (-)12.5rad~12.5rad total 25rad | p\_des=(58981/65535)\*25 + (-12.5)  = 9.99 rad |
| 4-7bit | 0x6 |
| DATA[1] | 0x65 | 0-3bit | 0x6 |
| 4-7bit | 0x5 |
| DATA[2] | 0x82 | 0-3bit | 0x8 | v\_des value is 0x82E decimal is (2094) | (-)45rad/s~4 5rad/s  total 90rad/s | v\_des=(2094/4095)\*90 + (-45)  = 1.021 rad/s |
| 4-7bit | 0x2 |
| DATA[3] | 0xE0 | 0-3bit | 0xE |
| 4-7bit | 0x0 | kp value is 0x52 decimal is (82) | 0~500  total 500 | kp=(82/4095)\*500 + 0 |
| DATA[4] | 0x52 | 0-3bit | 0x5 |
| 4-7bit | 0x2 |
| DATA[5] | 0x33 | 0-3bit | 0x3 | kd value is 0x333 decimal is (819) | 0~5  total 5 | kd=(819/4095)\*5 + 0 |
| 4-7bit | 0x3 |
| DATA[6] | 0x3B | 0-3bit | 0x3 |
| 4-7bit | 0xB | t\_ff value is 0xB55 decimal is (2901) | (-)24N-m~24N-m  totol 48N-m | t\_ff=(2901/4095)\*48 + (-24)  = 10.004 N-m |
| DATA[7] | 0x55 | 0-3bit | 0x5 |
| 4-7bit | 0x5 |

Reply command: ID No. 0x501

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Data field** | **Data** | **Data partition** | | **Data definition** | **Data range** | **Data calculation instructions** |
| DATA[0] | 0xE6 | 0-3bit | 0xE | p\_des value is 0xE665 decimal is (58981) | (-)12.5rad~12.5rad total 25rad | p\_des=(58981/65535)\*25 + (-12.5)  = 9.99 rad |
| 4-7bit | 0x6 |
| DATA[1] | 0x65 | 0-3bit | 0x6 |
| 4-7bit | 0x5 |
| DATA[2] | 0x82 | 0-3bit | 0x8 | v\_des value is 0x82E decimal is (2094) | (-)45rad/s~4 5rad/s  total 90rad/s | v\_des=(2094/4095)\*90 + (-45)  = 1.021 rad/s |
| 4-7bit | 0x2 |
| DATA[3] | 0xEB | 0-3bit | 0xE |
| 4-7bit | 0xB | t\_ff value is 0xB55 decimal is (2901) | (-)24N-m~24N  -m  total 48N-m | t\_ff=(2901/4095)\*48 + (-24)  = 10.004 N-m |
| DATA[4] | 0x52 | 0-3bit | 0x5 |
| 4-7bit | 0x2 |
| DATA[5] |  | 0-3bit |  |  |  |  |
| 4-7bit |  |
| DATA[6] |  | 0-3bit |  |
| 4-7bit |  |  |  |  |
| DATA[7] |  | 0-3bit |  |
| 4-7bit |  |

**6. RS485 multi-motor command (0xCD + command)**

**6.1. Command description**

The ID number is 0xCD, which means that multiple motors respond to the same command at the same time. The content and function of the command are the same as the single motor command, please refer to the single motor command for details.

**6.2. Example of communication**

Suppose there are 4 motors on the RS485 bus, and the ID numbers are 01, 02, 03, and 04 respectively.

**Example 1:**

**Send command:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0xCD | 0x08 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** 4 motors receive the 0x80 motor shutdown command at the same time (see 2.30 for details), and then all 4 motors immediately execute the motor shutdown command.

**Reply command:**

The 4 motors reply at the same time, and the reply IDs are their own ID numbers. The reply sequence depends on the respective delays on the bus.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** The motor whose ID number is 0x01 returns the corresponding command.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x02 | 0x08 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** The motor whose ID number is 0x02 returns the corresponding command.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x03 | 0x08 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** The motor whose ID number is 0x03 returns the corresponding command.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x04 | 0x08 | 0x80 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Description:** The motor whose ID number is 0x04 returns the corresponding command.

**Example 2:**

**Send command:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0xCD | 0x08 | 0x60 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L | CRC16H |

**Explanation:** 4 motors receive the 0x60 read multi-turn encoder position data command at the same time (see 2.21 for details), and then the 4 motors reply their respective multi-turn encoder position data.

**Reply command:**

The 4 motors reply at the same time, and the reply IDs are their own ID numbers. The reply sequence depends on the respective delays on the bus.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x01 | 0x08 | 0x60 | 0x00 | 0x00 | 0x00 | 0x10 | 0x27 | 0x00 | 0x00 | CRC16L | CRC16H |

**Explanation:** Data[4] to data[7] form a motor reply data with ID number 0x01 (Data[4] is the lowest bit, Data[7] is the highest bit) 32-bit data is 0x00002710, which means 10000 in decimal. The value of the multi-turn encoder representing the current relative multi-turn zero bias (initial position) of the motor is 10,000 pulses.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x02 | 0x08 | 0x60 | 0x00 | 0x00 | 0x00 | 0x20 | 0x4E | 0x00 | 0x00 | CRC16L | CRC16H |

**Explanation:** Data[4] to data[7] form a motor response data with ID number 0x02 (Data[4] is the lowest bit, Data[7] is the highest bit). The 32-bit data is 0x00004E20, which means 20000 in decimal. The value of the multi-turn encoder representing the current relative multi-turn zero bias (initial position) of the motor is 20,000 pulses.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x03 | 0x08 | 0x60 | 0x00 | 0x00 | 0x00 | 0x30 | 0x75 | 0x00 | 0x00 | CRC16L | CRC16H |

**Explanation:** Data[4] to data[7] form a motor response data with ID number 0x03 (Data[4] is the lowest bit, Data[7] is the highest bit). The 32-bit data is 0x00007530, which means 30000 in decimal. The value of the multi-turn encoder representing the current relative multi-turn zero bias (initial position) of the motor is 30,000 pulses.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame  Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L | CRC16H |
| 0x3E | 0x04 | 0x08 | 0x60 | 0x00 | 0x00 | 0x00 | 0x40 | 0x9C | 0x00 | 0x00 | CRC16L | CRC16H |

**Explanation:** Data[4] to data[7] in the reply data of the motor with the ID number 0x244 form one (Data[4] is the lowest bit, Data[7] is the highest bit). The 32-bit data is 0x00009C40, which means 40000 in decimal. The value of the multi-turn encoder representing the current relative multi-turn zero bias (initial position) of the motor is 40,000 pulses.

**7. RS485-ID setting command (0x79)**

**7.1. Instruction Description**

This command is used to set and read RS485 ID. Communication ID uses 0xCD, all devices on the bus will receive and process this command,

When modifying, you need to pay attention to whether multiple devices are connected, so that the IDs of multiple devices may be modified to the same at the same time.

The host sends this command to set and read the RS485 ID, the parameters are as follows.

3. The read and write flag bit wReadWriteFlag is bool type, 1 read 0 write.

4. RS485-ID, size range (#1~#32), uint16\_t type (synchronized with the upper computer function), device identifier ID (1~32).

**7.2. Send Data Field Definition**

|  |  |  |
| --- | --- | --- |
| **Data field** | **Explanation** | **Data** |
| DATA[0] | command byte | 0x79 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | read and write flags | DATA[2] = wReadWriteFlag |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | NULL | 0x00 |
| DATA[7] | RS485ID | DATA[7] = RS485ID(1~32) |

**7.3. Reply data field definition**

4. The motor replies to the host after receiving the command, which is divided into the following two situations:

5. Set RS485ID, the range is 1-32, and return to the original command.

6. Read RS485ID, the return parameters are as follows.

|  |  |  |
| --- | --- | --- |
| **Data field** | **Explanation** | **Data** |
| DATA[0] | command byte | 0x79 |
| DATA[1] | NULL | 0x00 |
| DATA[2] | read and write flags | DATA[2] = wReadWriteFlag |
| DATA[3] | NULL | 0x00 |
| DATA[4] | NULL | 0x00 |
| DATA[5] | NULL | 0x00 |
| DATA[6] | RS485 Low byte 1 | DATA[6] = (uint8\_t \*)(RS485ID) |
| DATA[7] | RS485 ID 2 | DATA[7] = (uint8\_t)(RS485ID>>8) |

**7.4. Communication example**

Example 1:

Send command:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L CRC16H |
| 0x3E | 0xCD | 0x08 | 0x79 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x02 | CRC16L CRC16H |

Description: Data[2] = 0 means write RS485ID. Data[7] = 1 means to set the motor RS485ID to 2.

Reply command:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L CRC16H |
| 0x3E | 0xCD | 0x08 | 0x79 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | 0x02 | CRC16L CRC16H |

Description: Same as sending command.

Example 2:

Send command:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L CRC16H |
| 0x3E | 0xCD | 0x08 | 0x79 | 0x00 | 0x01 | 0x00 | 0x00 | 0x00 | 0x00 | 0x00 | CRC16L CRC16H |

Description: Data[2] = 1 means to read RS485ID.

Reply command:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame Header | ID No. | Length | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | CRC16L CRC16H |
| 0x3E | 0xCD | 0x08 | 0x79 | 0x00 | 0x01 | 0x00 | 0x00 | 0x00 | 0x00 | 0x02 | CRC16L CRC16H |

**8.Indicator Light Description**

**8.1 Status Description**

·When the indicator light is solid on, it means the motor is running normally;

·Slow flashing indicates that the motor has a secondary error. If the recovery condition is reached, it will automatically return to normal operation, and the indicator light will be solid on for a long time;

·Flickering quickly indicates that the motor has a first-level error, and the motor cannot recover from the error. It is necessary to check the motor fault and restart before it can continue to run;

**8.2 Failure Description Form**

|  |  |  |
| --- | --- | --- |
| **Fault Name** | **Description** | **Error Level** |
| Hardware over-current | If the motor current exceeds the limit value, there may be short circuit, phase loss, loss of control, motor damage, etc. | Level 1 |
| Stall error | After the current reaches the stall current, the speed is very low and continues for a period of time. Indicates that the motor load is too large. | Level 1 |
| Under-voltage error | The power input is lower than the set undervoltage value | Level 2 |
| Over-voltage error | The power input is higher than the set overvoltage value | Level 2 |
| Phase-current over-current | The software detects that the motor current exceeds the limit value, and there may be short circuit, phase loss, loss of control, motor damage, etc. | Level 1 |
| Power overrun error | If the input current of the power supply exceeds the limit value, there may be a situation where the load is too large or the speed is too high. | Level 2 |
| Calibration parameter read error | Failed to write parameters causing parameter loss. | Level 1 |
| Over-speed error | The motor running speed exceeds the limit value, there may be overpressure and drag use. | Level 2 |
| Motor over-temperature error | If the motor temperature exceeds the set value, there may be short circuit, parameter error, and long-term overload use. | Level 2 |
| Encoder calibration error | The encoder calibration result deviates too much from the standard value. | Level 2 |

**9. Version revision information**

**V3.1 version:**

1) Version revision content:

a. Amend the reply data definition in the 5.0 operation control command;

2) Version revision date: 2022.6.23

**V3.2 version:**

1) Version revision content:

a. Increase the description of the indicator light;

2) Version revision date: 2022.7.27

**V3.3 version:**

1) Version revision content:

a. Add function control command 0x20: clear multi-turn value function and CAN filter enable control function;

2) Version revision date: 2022.7.31

**V3.4 version:**

1) Version revision content:

a. Increase the position tracking command 0xA3;

b. Increase the setting of 4 values of acceleration and deceleration for position planning and speed planning in the 0x43 command;

2) Version revision date: 2022.8.17

**V3.5 version:**

1) Version revision content:

a. Increase the position tracking command 0xA5 with speed limit;

b. Add function control command 0x20: error status sending and multi-turn value power-off saving selection function;

c. Add the 0xB5 command to read the motor model;

2) Version revision date: 2022.9.05

**V3.6 version:**

1) Version revision content:

b. Add RS485 broadcast command description 0xCD;

2) Version revision date: 2022.10.13

**V3.7 version:**

1) Version revision content:

a. Remove the A3 instruction;

b. Merge A5 into A4;

c. Add A6 single-turn position command;

d. Add the command 0x90 to read the single-turn encoder;

e. Add the command 0x94 to read the single-turn angle of the motor;

2) Version revision date: 2022.11.26

**V3.8 version:**

1) Version revision content:

a. RS485 protocol 2Mbps baud rate is changed to 2.5Mbps;

2) Version revision date: 2022.11.26