

Chapter I IMAX Controller hardware interface

1.1 IMAX Controller interface description

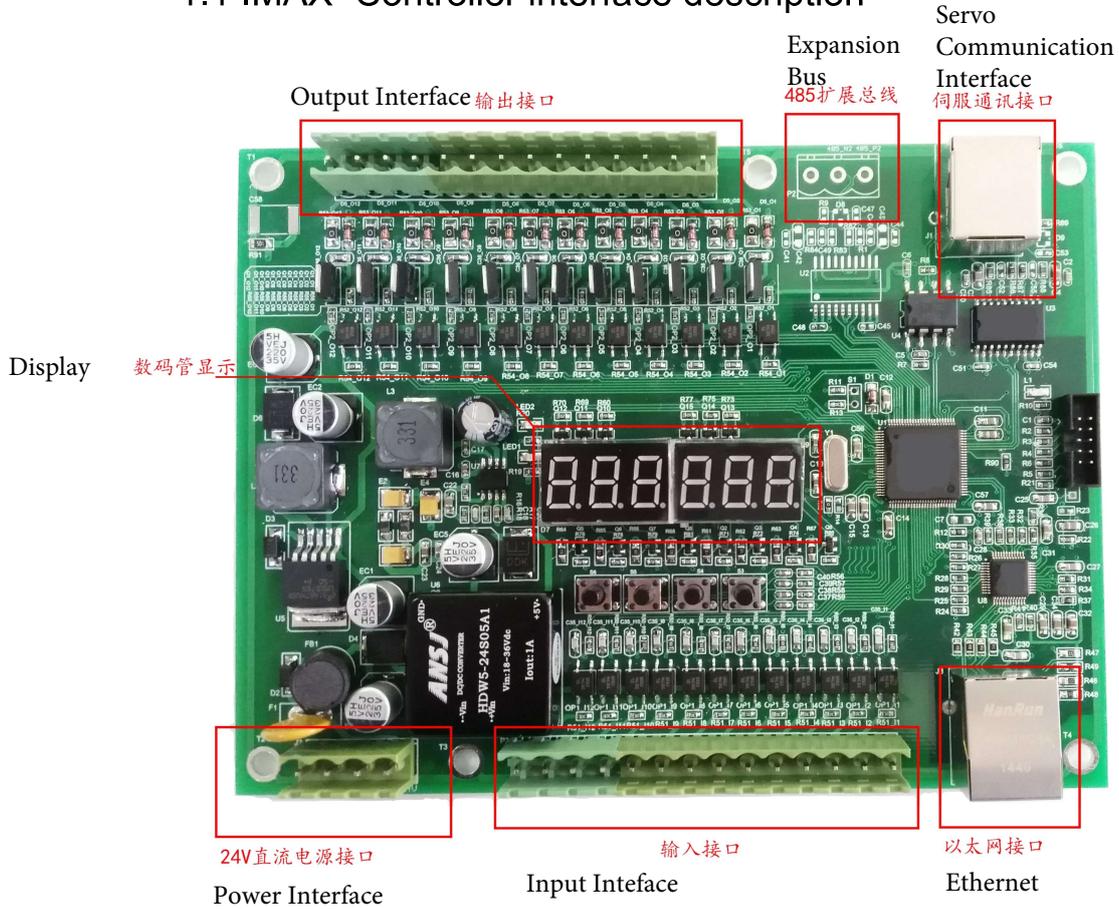


Figure 1 IMAX Controller interface description

1.2 IMAX Controller wiring

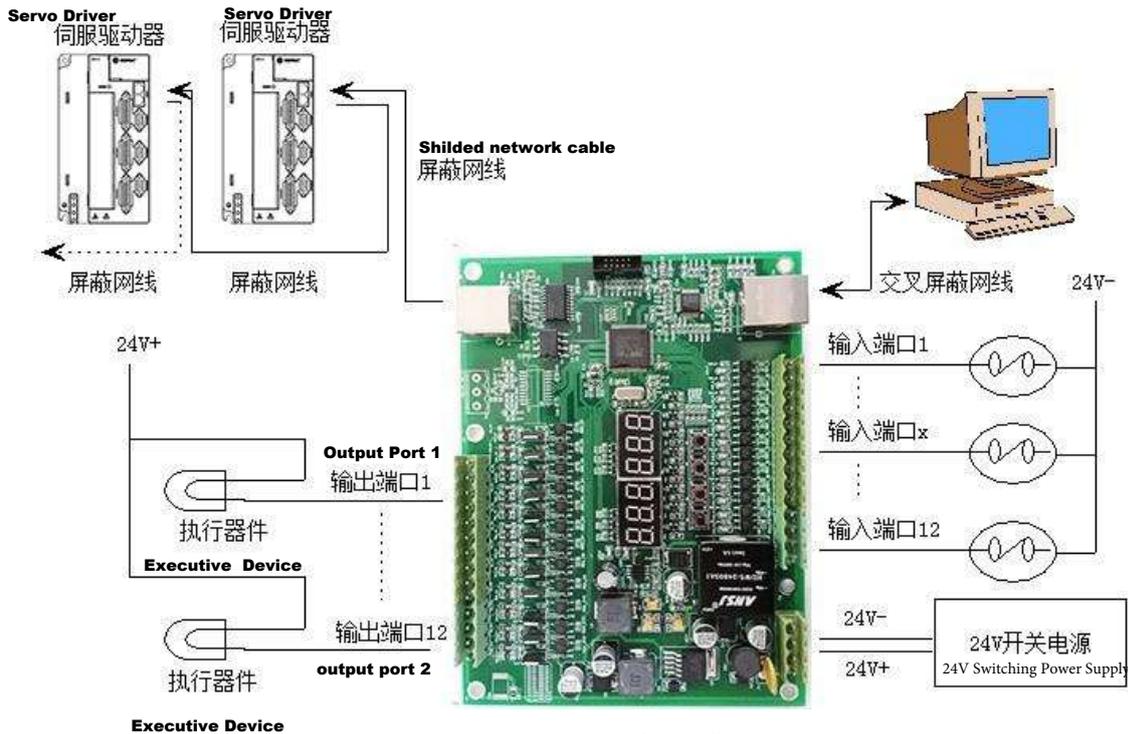


Figure 2 IMAX Wiring diagram

Chapter II Ethernet communication protocol

2.1 IMAX Overview of controller Ethernet communication

The system adopts Ethernet LAN and can/485 bus communication control scheme to realize multi axis networked servo control

Yes. The Ethernet communication of IMAX controller adopts UDP communication protocol.

2.2 IMAX Ethernet communication protocol of controller

2.2.1 IMAX Basic framework of controller Ethernet communication

This controller adopts UDP communication protocol, and the basic format of UDP is as follows.

By MAC address, IP address, and

The user-defined UDP source port number and target port number realize the flow control of Ethernet data. Interactive information is reflected in UDP data part.

| MAC Header (14 Bytes) | | |
|-----------------------|-----------------|--------|
| DA | SA | TYPE |
| \$.\$.\$.\$.\$. | \$.\$.\$.\$.\$. | 0x0800 |

| IP Header (20 Bytes) | | | | | | | | | |
|----------------------|----------|--------|-----|--------|-----|----------|-------|-----------|-----------|
| VerHead | Diff | Total | id | Flag | TTL | Protocol | Check | Source | Destinati |
| Length | Services | Length | | Offset | | Type | Sum | IP | onIP |
| 0x45 | \$ | \$. | \$. | \$. | \$ | 0x11 | \$. | \$.\$.\$. | \$.\$.\$. |

| UDP Header (8 Bytes) | | | |
|----------------------|------------------|--------|----------|
| Source Port | Destination Port | Length | Checksum |
| \$. \$ | \$. \$ | \$. \$ | \$. \$ |

| UDP Data | | |
|--------------------------------|----------------|----------------------|
| AppControlField | AppWhoField | AppDataField |
| \$. \$. \$. \$. \$. \$. \$. \$ | \$. \$. \$. \$ | \$. \$. \$. \$ |

| MAC Frame Check Sequence (4 Bytes) |
|-------------------------------------|
| \$. \$. \$. \$ |

The communication method of this controller can be addressed through MAC address, IP address and port number to realize point-to-point or point to multipoint. Interaction and broadcast communication. When the MAC address is 6 FF, it means physical address broadcast; When the IP segment address is 4 FF indicates logical address broadcast.

In this paper, the udpdata part of Ethernet is divided into three sub domains, which are appcontrolfield, Application handler field (appwhofield) and application data field (appdatafield)

| UDP Data | | |
|--------------------------------|----------------|----------------------|
| AppControlField | AppWhoField | AppDataField |
| \$. \$. \$. \$. \$. \$. \$. \$ | \$. \$. \$. \$ | \$. \$. \$. \$ |

Application control domain (AppControlField) Used to confirm UDP data message: (ConfirmCode), encryption (PassCode), Function selection (FunctionCode), Object channel selection (ObjectChannel). As shown in the following table.

| AppControlField | | | |
|-----------------|----------|--------------|------------|
| ConfirmCode | PassCode | FunctionCode | ObjectCode |
| \$. \$ | \$. \$ | \$. \$ | \$. \$ |

Where the application handler domain (AppWhoField) Used to indicate the receiving and response mode.

| AppWhoField | |
|-------------|-----------|
| AcceptCode | ReplyCode |
| \$. \$ | \$. \$ |

Acceptcode indicates the receiving method of the message. The host pair 256*256 can be achieved by setting this data field

Interactive communication of any slave site of the matrix. When the data field is ff.ff, it means that all stations receive it; Xx.ff means XX

Train full reception; Ff.yy indicates that YY line is fully received; Xx.yy indicates (XX, YY) point reception.

Especially when this data field

When it is 00.00, it means that the message does not need to be received; The data field of the message sent by the slave station is invalid,

and it is only received by the master station.

Replycode indicates the response method of the message. After receiving the message, the slave station will judge according to the data field Whether response processing is required. When the data field is ff.ff, it means that all slave stations respond; When xx.ff, it means that the XX column is complete

answer; Ff.yy means YY line full response; Xx.yy means (XX, YY) point response. Especially when the data field is 00.00

the means that there is no need to reply after the message is received from the station.

Appdatafield refers to the data information corresponding to the function code in the application control field. IMAX

The UDP data communication function supported by the controller and the basic operation of the application data field are shown in the following table.

| | master station | operation |
|----------------|----------------|---------------------------------------|
| master station | 0x1101 | Master read slave register operation |
| | 0x1201 | Master write slave register operation |

| | | |
|-----------------|---------|--|
| operation | 0x1301 | Master station sends absolute time multi axis motion data information |
| | 0x1401 | The master station sends relative time multi axis motion data information |
| Slave operation | 0x1001 | The slave station reports the specified operation status information |
| | 0x110x* | Slave reply register read operation |
| | 0x120x* | Slave reply register write operation |
| | 0x130x* | Slave station answers absolute time multi axis motion data information |
| | 0x140x* | Slave station responds to relative time multi axis motion data information |

*Note: x = 2 indicates that the receiving operation is correct and a correct response is made;
X = 3 indicates that the receiving operation is wrong and an incorrect response is made.

2.2.2 Ethernet UDP data domain description

UDP data field is the main information part of data packet, and its data format will vary according to different function codes.

2.2.2.1 IMAX Control card reports specified status information

When IMAX fails during operation and requires active alarm, it will report the specified status message to the Ethernet master station Interest.

| UDP Data | | | | | | | | |
|-----------------|--------------|---------------|----------------|-------------|------------|------------------|---------|---------------|
| AppControlField | | | | AppWhoField | | AppDataField | | |
| Confirm Code | Pass Code | Function Code | Object Channel | Accept Code | Reply Coce | RegStart Address | Reg Num | Reg Data |
| \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$.....\$ |
| 0x55aa | 0x00 0x00 | 0x1001 | 0x0000 | 0:Host | 0:None | x.x | x.x | x.....x |

2.2.2.2 Master station read IMAX register operation

| UDP Data | | | | | | | | |
|-----------------|--------------|---------------|--------------------|--|---|------------------|---------|---------------|
| AppControlField | | | | AppWhoField | | AppDataField | | |
| Confirm Code | Pass Code | Function Code | Object Channel | Accept Code | Reply Coce | RegStart Address | Reg Num | Extra Data |
| \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$.....\$ |
| 0x55aa | 0x00 0x00 | 0x1101 | 0: DPxx 1: PAxx | 0:none ff.ff :all ff.yy :line xx.ff :list xx.yy:me | 0:none ff.ff :all ff.yy:line xx.ff :list xx.yy:me | x.x | x.x | 00.....0 |

2.2.2.3 IMAXReturn to master station read register operation

IMAX Correct response operation

| UDP Data | | | | | | | | |
|-----------------|-----------|---------------|----------------|-------------|------------|------------------|---------|---------------|
| AppControlField | | | | AppWhoField | | AppDataField | | |
| Confirm Code | Pass Code | Function Code | Object Channel | Accept Code | Reply Coce | RegStart Address | Reg Num | Reg Data |
| \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$.....\$ |
| 0x55aa | 0x00 | 0x1102 | 0: DPxx | 0:none | 0:none | x.x | x.x | x.....x |

| | | | | | | | | |
|--|------|--|---------|--|--|--|--|--|
| | 0x00 | | 1: PAxx | | | | | |
|--|------|--|---------|--|--|--|--|--|

IMAXError response operation

| UDP Data | | | | | | | | |
|-----------------|--------------|---------------|--------------------|-------------|------------|------------------|---------|---------------|
| AppControlField | | | | AppWhoField | | AppDataField | | |
| Confirm Code | Pass Code | Function Code | Object Channel | Accept Code | Reply Coce | RegStart Address | Reg Num | Error Code |
| \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$.....\$ |
| 0x55aa | 0x00 0x00 | 0x1103 | 0: DPxx 1: PAxx | 0:none | 0:none | x.x | x.x | x.....x |

2.2.2.4 master station write IMAX register operation

| UDP Data | | | | | | | | |
|-----------------|--------------|---------------|----------------|---|---|------------------|---------|---------------|
| AppControlField | | | | AppWhoField | | AppDataField | | |
| Confirm Code | Pass Code | Function Code | Object Channel | Accept Code | Reply Coce | RegStart Address | Reg Num | Reg Data |
| \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$.....\$ |
| 0x55aa | 0x00 0x00 | 0x1201 | 0: PAxx | 0:none ff.ff :all ff.yy :line xx.ff :colur xx.yy:me | 0:none ff.ff :all ff.yy :line xx.ff :colur xx.yy:me | x.x | x.x | x.....x |

2.2.2.3imax return to master station write register operation

IMAX correct response operation

| UDP Data | | | | | | | | |
|-----------------|--------------|---------------|----------------|-------------|------------|------------------|---------|---------------|
| AppControlField | | | | AppWhoField | | AppDataField | | |
| Confirm Code | Pass Code | Function Code | Object Channel | Accept Code | Reply Coce | RegStart Address | Reg Num | Reg Data |
| \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$.....\$ |
| 0x55aa | 0x00 0x00 | 0x1202 | 0: PAxx | 0:none | 0:none | x.x | x.x | x.....x |

IMAX error response operation

| UDP Data | | | | | | | | |
|-----------------|--------------|---------------|----------------|-------------|------------|------------------|---------|---------------|
| AppControlField | | | | AppWhoField | | AppDataField | | |
| Confirm Code | Pass Code | Function Code | Object Channel | Accept Code | Reply Coce | RegStart Address | Reg Num | Error Code |
| \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$.....\$ |
| 0x55aa | 0x00 0x00 | 0x1203 | 0: PAxx | 0:none | 0:none | x.x | x.x | x.....x |

| | | | | | | | | | |
|--------|--------------|--------|-----------------------------------|---|---|---|-------|---|---|
| \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | L | L...L | L | L |
| 0x55aa | 0x00 0x00 | 0x1401 | 0: 3axis 1: 6axis x*: xaxis | 0:none ff.ff :all ff.yy :line xx.ff :colur xx.yy:me | 0:none ff.ff :all ff.yy :line xx.ff :colur xx.yy:me | | | | |

*Note L represents 4 bytes in length, with a total of 32 bits

2.2.2.7imax returns to the master station and writes absolute time multi axis motion data

IMAX correct response operation

| UDP Data | | | | | | | | | |
|-----------------|--------------|---------------|-----------------------------------|---|---|--------------|-------------|----------|----------|
| AppControlField | | | | AppWhoField | | AppDataField | | | |
| Confirm Code | Pass Code | Function Code | Object Channel | Accept Code | Reply Coce | RelaT ime | Play Moto r | Port Out | Play DAC |
| \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | L | L...L | L | L |
| 0x55aa | 0x00 0x00 | 0x1402 | 0: 3axis 1: 6axis x*: xaxis | 0:none ff.ff :all ff.yy :line xx.ff :colur xx.yy:me | 0:none ff.ff :all ff.yy :line xx.ff :colur xx.yy:me | | | | |

IMAX error response operation

| UDP Data | | | | | | | | | |
|-----------------|--------------|---------------|-----------------------------------|---|---|---------------|---|-------------------|----------|
| AppControlField | | | | AppWhoField | | AppDataField | | | |
| Confirm Code | Pass Code | Function Code | Object Channel | Accept Code | Reply Coce | Rela Time | Play Motor | Port Out | Play DAC |
| \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | \$. \$ | L* | L...L | L | L* |
| 0x55aa | 0x00 0x00 | 0x1403 | 0: 3axis 1: 6axis x*: xaxis | 0:none ff.ff :all ff.yy :line xx.ff :colur xx.yy:me | 0:none ff.ff :all ff.yy :line xx.ff :colur xx.yy:me | Relative time | Absolute state of corresponding shaft motor | Input port status | |

*Note L refers to 4-byte data length

2.3Description of controller parameters

IMAX controller parameters are divided into PA parameters and DP parameters; DP parameter is used for monitoring and scanning, and it is not guaranteed after power failure
Save, the master can only read but not write. PA parameters are the working parameters of the controller. Some of them are saved after power failure, and the master station can be written and readable.
Both PA and DP parameters are 32-bit data, and the addresses are 0x00 to 0xff.

2.3.1 PA Parameter description

| IMAX Operating parameters of controller | | |
|---|---------|---------------|
| Parameter name | explain | Default value |
| | | |

| | | |
|-------|---|------|
| PA 00 | Mode setting: 0:485 working mode; 1: Manual test mode; 2: Test mode 10: can working mode, 11: can input / output working mode, 12: test mode | 0 |
| PA 01 | Indicates UDP resolution mode, | 0 |
| PA 02 | Number of working servo motors: X is the number greater than 0 | 3 |
| PA 03 | Rotation axis No.: 0: no rotation axis, x:x axis is rotation axis | 0 |
| PA 04 | Input 1 to 32 signal selection: 0: normal, 1: negative | 1 |
| PA 05 | Output 1 to 32 signal selection: 0: normal, 1: negative | 0 |
| PA 06 | Fast forward enable: 0: send all received data; 1: If there are more than 2 data in the cache, the fast forward function is automatically enabled. | 1 |
| PA 07 | Maximum speed limit of motor operation | 3000 |
| PA 08 | Manual reset | 0 |
| PA 09 | When there is no time parameter instruction, the time interval parameter. | 100 |
| PA 0a | Time resolution method (0: use packet time, 1: use UDP receiving time) | 0 |
| PA 0b | Time data maximum limit | 3000 |
| PA 0c | Reset mode setting in can mode (0: custom mode, 1: Torque return to zero) | 1 |
| PA 0d | Not used yet | 0 |
| PA 0e | The upper computer controls the reset mode (0: reset, 1: return to the zero position) | 0 |
| PA 0f | Parameter initialization settings (used when the network cable is not connected) | 0 |

| IMAX controller UDP communication | | |
|-----------------------------------|---|---------------|
| Parameter name | explain | Default value |
| PA 10 | Controller IP address a:0 to 255 | 192 |
| PA 11 | Controller IP address b:0 to 255 | 168 |
| PA 12 | Controller IP address c:0 to 255 | 15 |
| PA 13 | Controller IP address d:0 to 255 | 201 |
| PA 14 | Controller communication port (local port number) | 7408 |
| PA 15 | UDP reply enable | 1 |
| PA 16 | Mac code 1 | 0 |
| PA 17 | Mac code 2 | 0 |
| PA 18 | Mac code3 | 0 |
| PA 19 | Mac code4 | 0 |
| PA 1a | Mac code5 | 0 |
| PA 1b | Mac code6 | 0 |
| PA 1c | Not used yet | 0 |
| PA 1d | Not used yet | 0 |
| PA 1e | Not used yet | 0 |
| PA 1f | Not used yet | 0 |

| UDP communication master station setting parameters | | |
|---|---------------------|---------------|
| Parameter name | explain | Default value |
| PA 20 | Master IP address a | 192 |
| PA 21 | Master IP address B | 168 |
| PA 22 | Master IP address C | 15 |

| | | |
|-------|---------------------|------|
| PA 23 | Master IP address D | 101 |
| PA 24 | Master port number | 8410 |
| PA 25 | Not used yet | 0 |
| PA 26 | Not used yet | 0 |
| PA 27 | Not used yet | 0 |
| PA 28 | Not used yet | 0 |
| PA 29 | Not used yet | 0 |
| PA 2a | Not used yet | 0 |
| PA 2b | Not used yet | 0 |
| PA 2c | Not used yet | 0 |
| PA 2d | Not used yet | 0 |
| PA 2e | Not used yet | 0 |
| PA 2f | Not used yet | 0 |

| Servo related parameters | | |
|--------------------------|---|---------------|
| Parameter name | explain | Default value |
| PA 30 | Setting of lowering torque of axis a (torque when finding zero point) | 47 |
| PA 31 | Setting of lowering torque of axis B (torque when finding zero point) | 47 |
| PA 32 | Setting of lowering torque of axis C (torque when finding zero point) | 47 |
| PA 33 | Setting of descending torque of axis U (torque when finding zero point) | 47 |
| PA 34 | Setting of descending torque of axis V (torque when finding zero point) | 47 |
| PA 35 | Setting of lowering torque of axis w (torque when finding zero point) | 47 |
| PA 36 | Not used yet | 0 |
| PA 37 | Not used yet | 0 |
| PA 38 | Not used yet | 0 |
| PA 39 | Not used yet | 0 |
| PA 3a | Not used yet | 0 |
| PA 3b | Not used yet | 0 |
| PA 3c | Custom change method | 0 |
| PA 3d | Control card start delay time | 1000 |
| PA 3e | Maximum zero finding distance (circle) under 485 communication mode | 60 |
| PA 3f | Reset speed under 485 communication mode (adjust the parameter value of servo pa775 under can mode) | 100 |

| Relevant parameters of electric cylinder | | |
|--|---|-----|
| Parameter name | explain | |
| PA 40 | Rising distance after zero point finding (0.1mm) | 100 |
| PA 41 | Pitch of electric cylinder (0.1mm) | 50 |
| PA 42 | Maximum stroke of electric cylinder (0.1mm) | 0 |
| PA 43 | When pa40=0, the safety height of the first axle (0.1mm) | 0 |
| PA 44 | When pa40=0, the safety height of the second axis (0.1mm) | 0 |
| PA 45 | When pa40=0, the safety height of the third axis (0.1mm) | 0 |
| PA 46 | When pa40=0, the safety height of the fourth axle (0.1mm) | 0 |
| PA 47 | When pa40=0, the safety height of the fifth axis (0.1mm) | 0 |

| | | |
|--------------------------------------|--|------------|
| PA 48 | When pa40=0, the safety height of the sixth axis (0.1mm) | 0 |
| PA 49 | Not used yet | 0 |
| PA 4a | Not used yet | 0 |
| PA 4b | Not used yet | 0 |
| PA 4c | Not used yet | 0 |
| PA 4d | Not used yet | 0 |
| PA 4e | Not used yet | 0 |
| PA 4f | Not used yet | 0 |
| Command filtering related parameters | | |
| Parameter name | explain | |
| PA 50 | Position command filtering time threshold (MS) | 100 |
| PA 51 | The exponential filtering depth (0-7) should be set to 0 in the case of negative position | 4 |
| PA 52 | Position error compensation coefficient (0: no compensation, 1: maximum compensation, 2:0.5 compensation, 3:0.25 compensation) | 0 |
| PA 53 | Not used yet | 0 |
| PA 54 | Not used yet | 0 |
| PA 55 | Not used yet | 0 |
| PA 56 | Not used yet | 0 |
| PA 57 | Not used yet | 0 |
| PA 58 | Not used yet | 0 |
| PA 59 | Not used yet | 0 |
| PA 5a | Not used yet | 0 |
| PA 5b | Not used yet | 0 |
| PA 5c | Not used yet | 0 |
| PA 5d | Not used yet | 0 |
| PA 5e | Not used yet | 0 |
| PA 5f | Not used yet | 0 |

| | | |
|--------------------------------------|---|-----|
| Relevant parameters of safety switch | | |
| Parameter name | explain | |
| PA 90 | 0x01: safety function enable +0x02: inching function enable +0x04: inching function enable | 0 |
| PA 91 | 0: keep still, and continue to move to the next position after stopping and releasing. 1. Return to zero point and move to the next position after the stop is released. 2. Keep still and return to zero point only after receiving reset. | 0 |
| PA 92 | Safety shutdown input IO port (for example, if X1 and X3 are used, it is set to 5) | 0 |
| PA 93 | Input X-port filtering time parameter | 200 |
| PA 94 | Safety speed limit when the alarm is released | 0 |
| PA 95 | Axis serial number deviation | 0 |
| PA 96 | Click in function IO selection, (invalid if it is repeated with PA92) | 0 |
| PA 97 | Click back function IO rotation (invalid if repeated with PA92) | 0 |
| PA 98 | Not used yet | 0 |
| PA 99 | Not used yet | 0 |

| | | |
|-------|---------------------------------|---|
| PA 9a | Not used yet | 0 |
| PA 9b | Not used yet | 0 |
| PA 9c | Not used yet | 0 |
| PA 9d | Not used yet | 0 |
| PA 9e | Manual I0 output setting | 0 |
| PA 9f | Output I0 initial value setting | 0 |

| Command filtering related parameters | | |
|--------------------------------------|--------------|-----|
| Parameter name | explain | |
| PA F0 | Not used yet | 100 |
| PA F1 | Not used yet | 4 |
| PA F2 | Not used yet | 0 |
| PA F3 | Not used yet | 0 |
| PA F4 | Not used yet | 0 |
| PA F5 | Not used yet | 0 |
| PA F6 | Not used yet | 0 |
| PA F7 | Not used yet | 0 |
| PA F8 | Not used yet | 0 |
| PA F9 | Not used yet | 0 |
| PA Fa | Not used yet | 0 |
| PA Fb | Not used yet | 0 |
| PA Fc | Not used yet | 0 |
| PA Fd | Not used yet | 0 |
| PA Fe | Not used yet | 0 |
| PA Ff | Not used yet | 0 |

2.3.3 DPParameter description

| UDP Communication master station setting parameters | | |
|---|----------------------------------|--|
| Parameter name | explain | |
| DP 00 | Working speed of axis 1 | |
| DP 01 | Working speed of axis 2 | |
| DP 02 | Working speed of axis 3 | |
| DP 03 | Not used yet | |
| DP 04 | Not used yet | |
| DP 05 | Not used yet | |
| DP 06 | 16 bits high for axis 1 position | |
| DP 07 | 16 lower bits of axis 1 position | |
| DP 08 | 16 bits high in axis 2 position | |
| DP 09 | 16 lower bits of axis 2 position | |
| DP 0a | 16 bits high in axis 3 position | |
| DP 0b | Lower 16 bits of axis 3 position | |
| DP 0c | Not used yet | |

| | |
|-------|---------------------------------------|
| DP 0d | Not used yet |
| DP 0e | Not used yet |
| DP 0f | Not used yet |
| DP 1B | Working speed of axis 4 |
| DP 1C | Working speed of axis 5 |
| DP 1D | Working speed of axis 6 |
| DP 21 | 16 bits high in axis 4 position |
| DP 22 | Lower 16 bits of axis 4 position |
| DP 23 | 16 bits high in axis 5 position |
| DP 24 | Lower 16 bits of axis 5 position |
| DP 25 | 16 bits high in axis 6 position |
| DP 26 | 16 lower bits of axis 6 position |
| | |
| DP 53 | |
| DP 54 | |
| DP 55 | |
| DP 49 | UDP data cache read pointer |
| DP 48 | UDP data cache write pointer |
| DP 5E | Digital input logic |
| DP 66 | Digital output logic |
| DP 80 | Axis 1 position deviation |
| DP 81 | Axis 2 position deviation |
| DP 83 | Axis 3 position deviation |
| | |
| DP F0 | Control register |
| DP F1 | Digital output logic setting register |
| DP F5 | Current working axis number |
| DP F6 | UDP packet receiving interval |
| DP FE | Servo driver alarm type |
| DP FF | Software version number |

Chapter III parameter setting and modification

The nixie tube point is facing down, and the buttons from left to right are mod key, left shift key, increase key and set key.

1. Steps for setting PA parameters:

- 1) Power on nixie tube cycle jump display;
- 2) Press the mod key until the nixie tube displays paxx, where X represents hexadecimal digits 0 to f;
- 3) Press the move left and add keys to modify XX to the desired parameter;
- 4) Press the set key to enter the parameter setting;
- 5) You can see that the nixie tube displays a number between 0 and 999999;

- 6) Press the move left and increase keys to modify the parameter to the desired value;
 - 7) Press the set key to set and exit to paxx;
 - 8) Press the mod key to display eeop on the nixie tube;
 - 9) Long press the set key to change the nixie tube from eeop to cycle jump display, and the parameters are saved successfully.
2. Steps to query DP parameters:
- 1) Power on nixie tube cycle jump display;
 - 2) Press mod key to display dpxx on the nixie tube, where X represents a hexadecimal number 0 to f;
 - 3) Press the move left and add keys to modify XX to the desired parameter;
 - 4) Press the set key to enter the parameter display. The digital tube displays the DP parameter.
3. Parameter saving steps
- 1) Power on nixie tube cycle jump display;
 - 2) Press mod key to eeop display;
 - 3) Long press the set key to make the nixie tube enter the cycle jump display state, and the parameters are saved successfully.

Chapter IV Ethernet debugging

4.1 IMAX Connection between controller and computer

IMAX controller and computer need to communicate through LAN. Therefore, LAN setting is required first. Set. Click computer control panel -> network and Sharing Center -> change adapter control -> local connection. Right click the attribute and pop up Out of the local connection property setting dialog box.

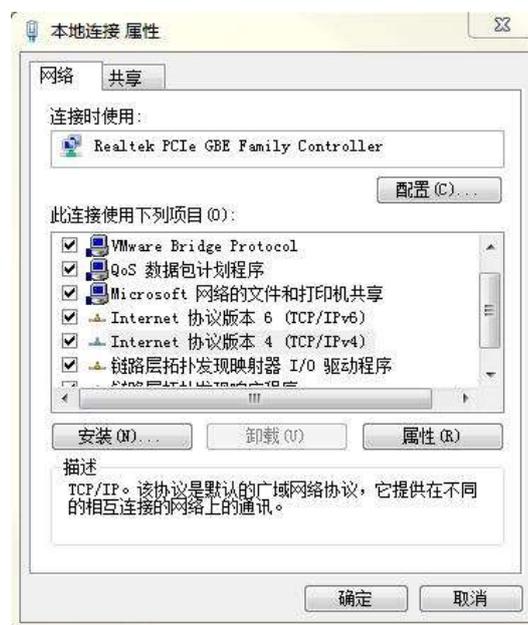


Figure 3 local connection attribute settings

Select Internet Protocol version 4 (tcp/ipv4), and click properties to pop up the property setting dialog box

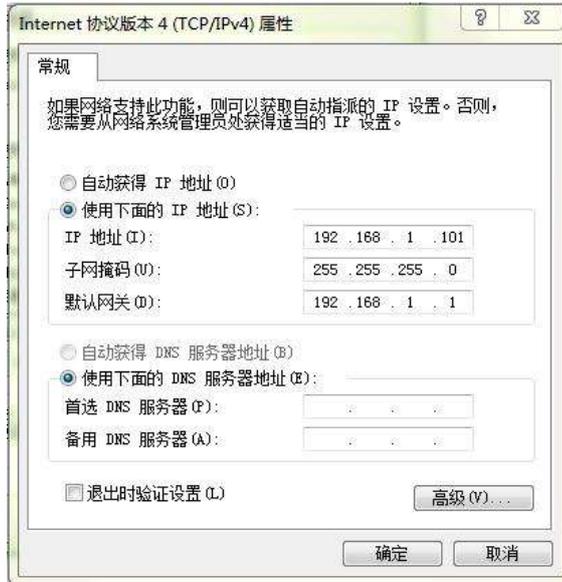


Figure 4 IP address setting of master station

Set the local IP address and default gateway, and click OK to exit the setting.

After setting the IP address of the computer master station, you also need to set the IP address of the IMAX controller. According to the ground IP address, the parameter values from PA20 to pa23 of the IMAX controller are set.

If the IP address is as shown in the above figure, the IMAX control parameters should be set as shown in the following table.

| parameter | PA 20 | PA 21 | PA 22 | PA 23 |
|-----------|-------|-------|-------|-------|
| Set value | 192 | 168 | 1 | 101 |

After setting the master IP parameters of the IMAX controller, you also need to set its own IP address. For the convenience of networking, the IP address of the IMAX controller should be in the same network segment as the IP address of the computer master station. As shown in the following table.

| parameter | PA 10 | PA 11 | PA 12 | PA 13 |
|-----------|-------|-------|-------|-------|
| Set value | 192 | 168 | 1 | 201 |

After the setting is completed, the connection test can be carried out through the ping command. The test results are shown below.

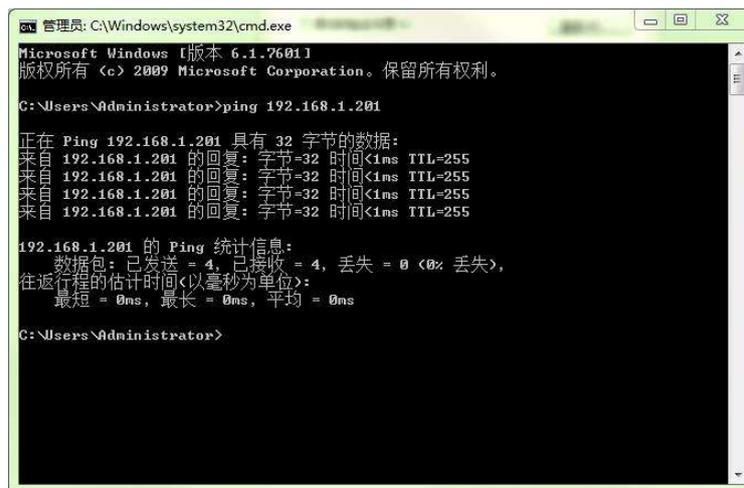


Figure 5 Ping connection test diagram

3.2 IMAX Communication test and packet capturing experiment between controller and master station

After the IMAX control is connected with the master station, simple data can be sent through MATLAB software for action testing.

Open Wireshark software, select the local connection, and click start to enter the monitoring interface. As shown in the following figure.



Figure 6wireshark software startup monitoring

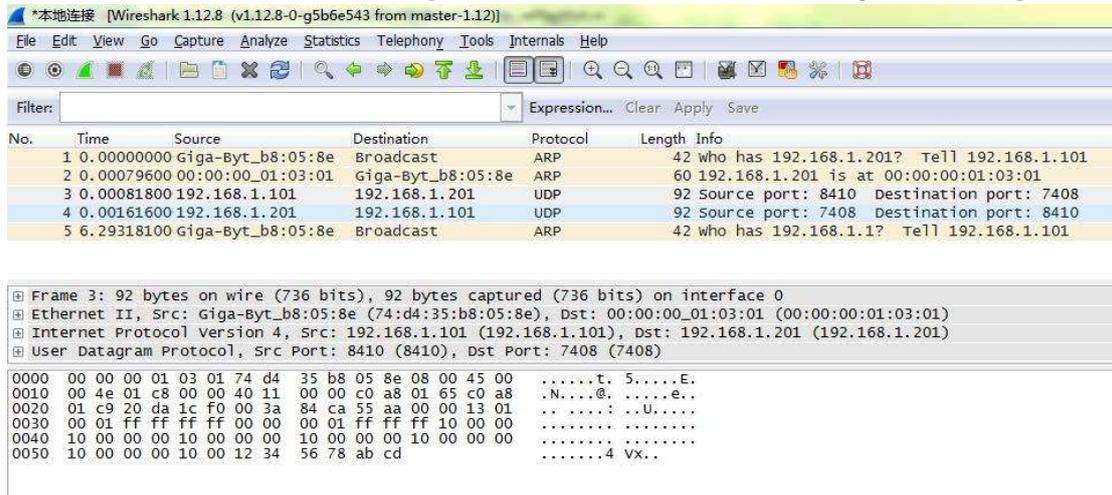


Figure 7wireshark software capture

Open the MATLAB software, click open, select the test m file, set the slave address and click Run In the Wireshark interface, you can see the UDP data sent by the master station and the data returned by the slave station.

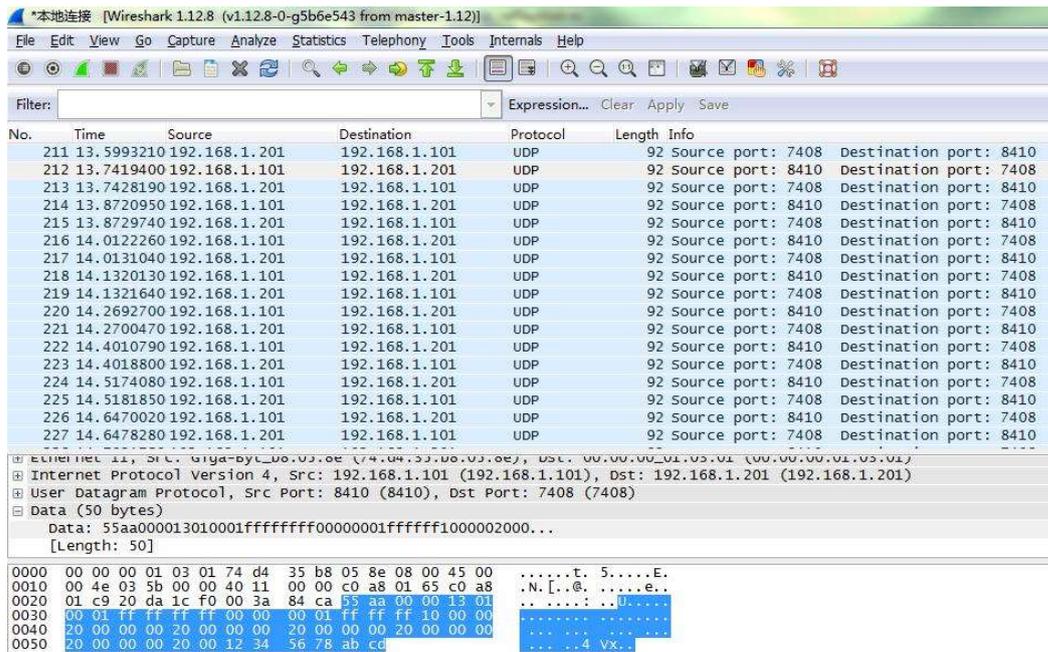


Figure 8 master station sends IMAX controller to receive data packets

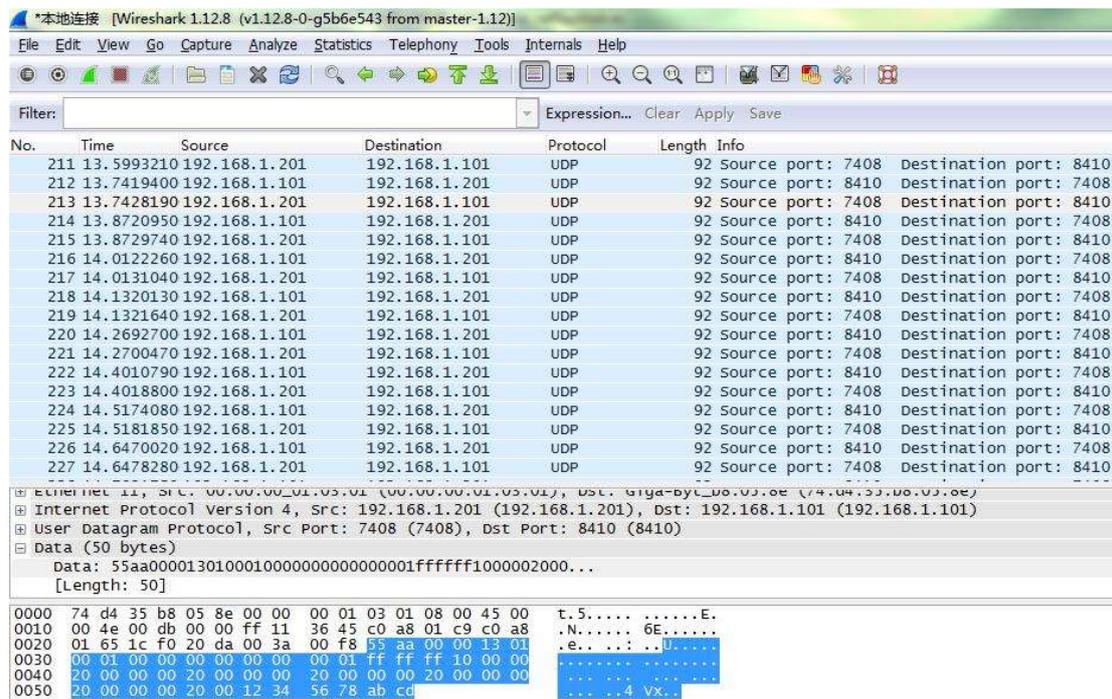


Figure 9imax controller return data

Chapter V installation and commissioning instructions

Several parameters that should be paid attention to when installing and debugging IMAX controller.

5.1 IP address of network connection

| IMAX controller UDP communication | |
|-----------------------------------|---|
| Parameter name | explain |
| PA 10 | Controller IP address a:0 to 255 |
| PA 11 | Controller IP address b:0 to 255 |
| PA 12 | Controller IP address c:0 to 255 |
| PA 13 | Controller IP address d:0 to 255 |
| PA 14 | Controller communication port (local port number) |
| PA 15 | UDP reply enable |

The IP address of Leke's playback platform is 192.168.15.201:7408; Therefore, the parameter is set to PA10=192; PA11=168; PA12=15; PA13=201; PA14=7408.

Leke's playback platform does not need to send UDP packets, so pa15 can be set to 0, so UDP response is prohibited OK.

| UDP communication master station setting parameters | |
|---|---------------------|
| Parameter name | explain |
| PA 20 | Master IP address a |
| PA 21 | Master IP address B |
| PA 22 | Master IP address C |

| | |
|-------|---------------------|
| PA 23 | Master IP address D |
| PA 24 | Master port number |

To realize the return of UDP packets, it is necessary to correctly set the master station IP address, such as the master station IP of Leke's playback platform 192.168.15.101:8410; Therefore, the parameter is set to pa20=192; PA21=168; PA22=15; PA23=101; PA24=8410;

5.2 control mode of IMAX controller

| IMAX controller operating parameters | |
|--------------------------------------|--|
| Parameter | name explain |
| PA 00 | Working mode setting: 0: working mode; 1: Manual test mode; 2: Test mode |
| PA 02 | Number of working servo motors: X is the number greater than 0 |
| PA 03 | Rotation axis No.: 0: no rotation axis, x:x axis is rotation axis |
| PA 07 | Maximum speed limit |
| PA 08 | Manual reset |
| PA 09 | Fixed time interval parameter without time parameter |
| PA 0a | Time value mode setting (0: get the time code in the control instruction, 1: get the UDP packet time interval) |
| PA 0b | Maximum command time setting |
| PA 0c | Reset mode setting (0: user-defined reset mode, 1: torque reset mode) |
| PA 0f | Parameter initialization settings (used when the network cable is not connected) |

To make the controller work normally, pa00=0 must be guaranteed in 485 mode and pa00=10 in can mode;

The number of IMAX controller control axes needs to be set according to different applications, for example, the animation seat with 2 seats is composed of 3

Pa02=3 for three electric cylinders, or pa02=4 for three seat 9D animation seats controlled by four electric cylinders; Some animation seats need to have the function of rotation, such as the three seat 9D animation seat. At this time, you need to

PA03 is set according to the data position. Generally, the last group of data is used as the rotation axis data in the data format, for example, in 3

On the 9D animation seat of seat, pa03=4;

In order to protect the servo and avoid the servo alarm, a software protection is needed at this time. Generally, the servo motor is the largest

When the speed is 3000 rpm, pa07 should be set to 3000;

When it is necessary to manually reset the electric lever, pa08 can be set to 1, and then IMAX control will control

The servo motor is reset, and pa08 is automatically reset to 0 after reset.

Some players do not have absolute time or relative time when playing data. At this time, a fixed time interval needs to be set. Separate parameters to ensure that each action data can be completed on time. For example, the player wants 100ms to be a UDP packet

Pa09 can be set to 100.

The first time maximum value setting is used to limit the size of UDP packet time value. When the time value is greater than pa0b Value, the value of pa0b will be taken as the time value.

When pa0f is set to 1, the parameter initialization operation will be carried out and initialized to the default value.

This operation requires that the network cable is not connected

When it is used, it will be automatically cleared after initialization. After query initialization, it needs to be powered on again to work normally.

5.4 setting of zero return torque

| Parameter name | explain |
|----------------|---|
| PA 30 | Setting of lowering torque of axis a (torque when finding zero point) |
| PA 31 | Setting of lowering torque of axis B (torque when finding zero point) |
| PA 32 | Setting of lowering torque of axis C (torque when finding zero point) |
| PA 33 | Setting of descending torque of axis U (torque when finding zero point) |
| PA 34 | Setting of descending torque of axis V (torque when finding zero point) |

| | |
|--------------|---|
| PA 35 | Setting of lowering torque of axis w (torque when finding zero point) |
|--------------|---|

When the electric cylinder returns to zero, it can use the way of additional sensors or through torque control to find the zero position. When using force
 When the torque control method is used to zero, the torque during zero can be set by setting the parameters pa30 to pa35. one
 Generally, when considering the load, the torque value is between 35 and 47. When reset and change occurs, an electric cylinder does not return
 To the bottom, consider increasing the PA parameter of the corresponding axis.

5.5 rise protection distance setting

| Relevant parameters of electric cylinder | |
|--|--|
| Parameter name | explain |
| PA 40 | Rising distance after zero point finding (0.1mm) |
| PA 41 | Pitch of electric cylinder (0.1mm) |

After the electric cylinder returns to zero, there is a rising process to protect the seat from touching the bottom during movement. Pa40 and can be set
 Pa41 parameter to adjust the rising distance. For example, when the pitch of the electric rod is 5mm and the desired rise distance is 10mm, you can
 Pa40=100, pa41=50. At this time, after the electric bar finds the zero position, the servo motor will rotate for 2 turns (pa40 divided by pa41
 The obtained value) makes the electric cylinder rise 10mm.

5.6 safety belt and emergency stop function:

| Safety belt function related parameters | |
|---|---|
| Parameter name | explain |
| PA 04 | Input I0 signal selection (0: high level is valid, 1: low level is valid), When the switch is not connected after power on, the input I0 is at high level |
| PA 90 | Safety belt function setting 0x01 |
| PA 91 | Safe parking mode: 0: keep still, and continue to move to the next position after stopping and releasing. 1. Return to zero point and move to the next position after the stop is released. 2. Keep still and return to zero only after receiving the reset command. |
| PA 92 | Safety shutdown input I0 port (for example, if X1 and X3 are used, it is set to 5) |
| PA 93 | Input X-port filtering time parameter |
| PA 94 | Speed limit when safe parking is released |

It is recommended to use the normally open switch as the button for the safety belt and emergency stop function.
 1. If you want to use X01 port and normally open switch to realize the emergency stop function, the platform will not move until the switch is pressed down
 When the machine sends out reset, it realizes safe reset. Parameters can be set as follows

| | |
|-------|---------|
| PA 04 | 1 |
| PA 90 | 0x01 |
| PA 91 | 2 |
| PA 92 | 1 |
| PA 93 | default |
| PA 94 | default |

2. If we want to use X01 and X02 as seat belt functions to realize that the platform moves when a seat belt is fastened, two Return to zero when the safety belts are disengaged. Only one safety belt can work normally.
 First, select the normally closed switch as the safety belt switch. And set parameters as follows

| | |
|-------|------|
| PA 04 | 1 |
| PA 90 | 0x01 |

| | |
|-------|---------------|
| PA 91 | 1 |
| PA 92 | 0x01+0x02 = 3 |
| PA 93 | default |
| PA 94 | default |

5.7 rotating platform Description:

| Relevant parameters | |
|---------------------|---|
| Parameter name | explain |
| PA 03 | Rotation axis serial number setting, (refers to the axis with the current position as zero) |
| PA 40 | Rising distance after zero point finding (0.1mm) |
| PA 41 | Pitch of electric cylinder (0.1mm) |
| PA 42 | Maximum stroke of electric cylinder (0.1mm) |
| PA 50 | Position command filtering time threshold (MS) |
| PA 51 | Exponential filtering depth (0-7) |

If it is necessary to reset an axis with the current position as zero, the value of PA03 can be set as the serial number of the axis.

If you need to achieve 360 degree rotation, or when the zero point is in the middle, you need to set pa51 to 0, shielding index

Filtering, in this case, the position of 100 is 0x00000064, and the position of -100 is 0xffff9c.

The zero offset set by pa40, pa41... Is to reserve a safe position for the normal operation of the motor

Position of 0x00000000 of machine control command = mechanical zero position +pa40/pa41 (zero offset position) + servo driver zero

Point return position (pa777 parameter of the drive).

5.8 Instruction filtering description

| Relevant parameters | |
|---------------------|---|
| Parameter name | explain |
| PA 50 | Position command filtering time threshold (MS) |
| PA 51 | Exponential filtering depth (0-7) |
| PA 52 | Position error compensation coefficient (0: no compensation, 1: maximum compensation, 2:1/2 compensation, 3:1/4 compensation) |

The exponential filter is used inside the control card to smooth the position instructions sent by the upper computer, and the smoothing depth is determined by pa51

Set, 0: do not use exponential filter, 1: do not smooth, 2-7: use exponential filter to smooth, the greater the value, the better the smoothing effect

The better. The recommended value is 4. When there is a negative position value, pa51 should be set to 0.

Pa52 is used to adjust the deviation between the servo driver and the command position. The larger the compensation is, the more accurate the servo control position is,

But the continuity of action will decrease. It is recommended that pa52 be set to 5.

5.9 Customize the setting of change method

| Relevant parameters | |
|---------------------|---|
| Parameter name | explain |
| PA 0c | Change method setting (0: custom change, 1: torque limit change) |
| PA 3c | Customize the setting of zero adjustment method (0: torque zero adjustment method, 1: sensor zero adjustment) |

In 485 mode, the limit sensor mode and torque limit mode are effective at the same time, and do not need to be set.

In can mode, the origin sensor mode and torque limit mode are not effective at the same time, and pa0c and pa3c need to be set

Make a selection. If the platform is composed of 4 axes, and you want the 1st and 3rd axes to use the sensor mode, you should set

PA0c=0; PA3c=5 (0x01+0x04) ;

5.10 axis serial number deviation setting

| | | |
|-------|------------------------------|---|
| PA 95 | Axis serial number deviation | 0 |
|-------|------------------------------|---|

If it is necessary to realize an instruction to control two control cards to perform actions at the same time, and these two control cards take

For the data of different axes, you need to set the parameter pa95, which is 0 by default. If pa95 is set to 6, this control

The first axis of business card printing takes the position value of the 7th axis in the command.

Chapter VI abnormal display

Description of abnormal operation of control card

The following display will be provided when the control card detects abnormal communication and data processing

| Display value | explain |
|---------------|--|
| Err 0 | Not used yet |
| Err 1 | The communication with servo shaft 1 is abnormal, and it is cleared after the communication connection is normal |
| Err 2 | The communication with servo shaft 2 is abnormal, and it is cleared after the communication connection is normal |
| Err 3 | The communication with servo axis 3 is abnormal, and it is cleared after the communication connection is normal |
| Err 4 | The communication with servo axis 4 is abnormal, and it is cleared after the communication connection is normal |
| Err 5 | The communication with servo axis 5 is abnormal, and it is cleared after the communication connection is normal |
| Err 6 | The communication with servo shaft 6 is abnormal, and it is cleared after the communication connection is normal |
| Err7 | Servo is abnormal, and the selected servo model does not match |
| Err 10 | Servo axis 1 alarm, re power on and clear, servo alarm detected |
| Err 11 | Servo axis 2 alarm, re power on and clear, servo alarm detected |
| Err 12 | Servo axis 3 alarm, re power on and clear, servo alarm detected |
| Err13 | Servo axis 4 alarm, re power on and clear, servo alarm detected |
| Err14 | Servo axis 5 alarm, re power on and clear, servo alarm detected |
| Err15 | Servo axis 6 alarms, power on again to clear, and servo alarm is detected |
| Err17 | If the initial playback time is too long, power on again or reset and clear (this alarm will be sent when pa0d=0) |
| Err 20 | UDP memory overflows, UDP communication is abnormal, and it will be cleared automatically after normal communication |
| Err21 | UDP data cache overflow, caused by abnormal playback. Power on again or reset and clear |

| | | |
|--|--|--|
| | | |
| | | |
| | | |