通讯协议

-通讯方式：串口

-波 特 率：115200

-特 征：8个数据位，1个停止位，没有奇偶校验

Communication Format

|  |  |  |
| --- | --- | --- |
| Byte 1 (Beginning Flag) | Byte 2 (Instruction Type) | Other Bytes (Data) |
| 0xFE | 0xF1~0xFC | 0~127 (0x00~0x7F) |

设置马达状态：7Bot有3种设置模式。普通模式可以转换到跟随操作模式或者保护模式，反之亦然。但是跟随模式和保护模式不能直接互相转换。

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| --- | --- | --- |
| Byte 1 (Beginning Flag) | Byte 2 (Instruction Type) | Byte 3 (Status) |
| 0xFE | 0xF5 | 0-跟随模式, 1-普通模式(default), 2-保护模式 |

设置7Bot的流畅性和速度：流畅意味着电机的加速和减速过程，这将影响运动是否流畅

|  |  |
| --- | --- |
| Byte 1 (Beginning Flag) | 0xFE |
| Byte 2 (Instruction Type) | 0xF7 |
| Byte 3 (motor 0 data) | bit 6: 0-默认, 1-手动设置;  bit 5~0: s速度值(范围:0~25, 10 意味着转100度需要1s) |
| Byte 4 (motor 1 data) | bit 6: 0-默认, 1-手动设置;  bit 5~0: s速度值(范围:0~25, 10 意味着转100度需要1s) |
| Byte 5 (motor 2 data) | bit 6: 0-默认, 1-手动设置;  bit 5~0: s速度值(范围:0~25, 10 意味着转100度需要1s) |
| Byte 6 (motor 3 data) | bit 6: 0-默认, 1-手动设置;  bit 5~0: s速度值(范围:0~25, 10 意味着转100度需要1s) |
| Byte 7 (motor 4 data) | bit 6: 0-默认, 1-手动设置;  bit 5~0: s速度值(范围:0~25, 10 意味着转100度需要1s) |
| Byte 8 (motor 5 data) | bit 6: 0-默认, 1-手动设置;  bit 5~0: s速度值(范围:0~25, 10 意味着转100度需要1s) |
| Byte 9 (motor 6 data) | bit 6: 0-默认, 1-手动设置;  bit 5~0: s速度值(范围:0~25, 10 意味着转100度需要1s) |

设置电机角度：每个电机最多可以转到180°，用10 bits的数据(0~1000)来表达0~180度的角度，所以电机的最大精度为0.18°

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| --- | --- |
| Byte 1 (Beginning Flag) | 0xFE |
| Byte 2 (Instruction Type) | 0xF9 |
| Byte 3 (motor 0 data) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 4 (motor 0 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 5 (motor 1 data) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 6 (motor 1 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 7 (motor 2 data) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 8 (motor 2 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 9 (motor 3 data) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 10 (motor 3 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 11 (motor 4 data) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 12 (motor 4 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 13 (motor 5 data) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 14 (motor 5 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 15 (motor 6 data) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 16 (motor 6 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |

给出joint6在笛卡尔坐标系的位置，给出5到6的方向向量和6到7的方向向量，IK将会自动计算电机0~5号的角度，但是6号向量的位置必须单独给

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| --- | --- |
| Byte 1 (Beginning Flag) | 0xFE |
| Byte 2 (Instruction Type) | 0xFA |
| Byte 3 (joint6.x) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 4 (joint6.x) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 5 (joint6.y) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 6 (joint6.y) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 7 (joint6.z) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 8 (joint6.z) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 9 (vec56.x) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 10 (vec56.x) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 11 (vec56.y) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 12 (vec56.y) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 13 (vec56.z) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 14 (vec56.z) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 15 (vec67.x) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 16 (vec67.x) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 17 (vec67.y) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 18 (vec67.y) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 19 (vec67.z) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 20 (vec67.z) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 21 (motor 6) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 22 (motor 6) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |

IK5:给出joint6点在笛卡尔坐标系中的位置然后给出joint5到joint6的向量，接着IK将会自动计算0~4号电机的角度，但是5~6号电机的位置需要你单独给

|  |  |
| --- | --- |
| Byte 1 (Beginning Flag) | 0xFE |
| Byte 2 (Instruction Type) | 0xFB |
| Byte 3 (joint6.x) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 4 (joint6.x) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 5 (joint6.y) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 6 (joint6.y) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 7 (joint6.z) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 8 (joint6.z) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 9 (vec56.x) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 10 (vec56.x) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 11 (vec56.y) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 12 (vec56.y) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 13 (vec56.z) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 14 (vec56.z) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 15 (motor 5) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 16 (motor 5) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 17 (motor 6) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 18 (motor 6) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |

IK3:给出joint5点在7Bot笛卡尔坐标系中的位置，然后IK将会自动计算并设置0~2号电机的位置，但是3~6号的位置必须由你来指定

|  |  |
| --- | --- |
| Byte 1 (Beginning Flag) | 0xFE |
| Byte 2 (Instruction Type) | 0xFC |
| Byte 3 (joint5.x) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 4 (joint5.x) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 5 (joint5.y) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 6 (joint5.y) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 7 (joint5.z) | **[Hight Byte]** bit 3: 0-Positive Value, 1-Negative Value; bit 2~0: 3 high bits of this Value |
| Byte 8 (joint5.z) | **[ Low Byte ]** bit 6~0: 7 low bits of this Value |
| Byte 11 (motor 3) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 12 (motor 3) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 13 (motor 4) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 14 (motor 4) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 15 (motor 5) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 16 (motor 5) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 17 (motor 6) | **[Hight Byte]** bit 2~0: 3 high bits of Motor Position |
| Byte 18 (motor 6) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |

从7Bot获取数据

反馈：每个电机最大可以转到180度，使用10bit（0~1000）来记录数据（0~180°），同时受力数据范围为-7~7

|  |  |
| --- | --- |
| Byte 1 (Beginning Flag) | 0xFE |
| Byte 2 (Instruction Type) | 0xF9 |
| Byte 3 (motor 0 data) | **[Hight Byte]** bit 6: force direction (0-positive, 1-negative)  bit 5~3: force level (0~7)  bit 2~0: 3 high bits of Motor Position |
| Byte 4 (motor 0 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 5 (motor 1 data) | **[Hight Byte]** bit 6: force direction (0-positive, 1-negative)  bit 5~3: force level (0~7)  bit 2~0: 3 high bits of Motor Position |
| Byte 6 (motor 1 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 7 (motor 2 data) | **[Hight Byte]** bit 6: force direction (0-positive, 1-negative)  bit 5~3: force level (0~7)  bit 2~0: 3 high bits of Motor Position |
| Byte 8 (motor 2 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 9 (motor 3 data) | **[Hight Byte]** bit 6: force direction (0-positive, 1-negative)  bit 5~3: force level (0~7)  bit 2~0: 3 high bits of Motor Position |
| Byte 10 (motor 3 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 11 (motor 4 data) | **[Hight Byte]** bit 6: force direction (0-positive, 1-negative)  bit 5~3: force level (0~7)  bit 2~0: 3 high bits of Motor Position |
| Byte 12 (motor 4 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 13 (motor 5 data) | **[Hight Byte]** bit 6: force direction (0-positive, 1-negative)  bit 5~3: force level (0~7)  bit 2~0: 3 high bits of Motor Position |
| Byte 14 (motor 5 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 15 (motor 6 data) | **[Hight Byte]** bit 6: force direction (0-positive, 1-negative)  bit 5~3: force level (0~7)  bit 2~0: 3 high bits of Motor Position |
| Byte 16 (motor 6 data) | **[ Low Byte ]** bit 6~0: 7 low bits of Motor Position |
| Byte 16 (converge flag) | 0-not converge(motors still moving); 1-converge(motors finish moving) |