

## 苏州脉塔智能科技有限公司

MyActuator Technical Document

# 产品规格书

PRODUCT SPECIFICATION

|                     |                     |
|---------------------|---------------------|
| 产品名称 / Product Name | RMD-X4-P36-36-E-L   |
| 版本/Version          | V1.0                |
| 日期 / Date           | 2026-08-08          |
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文档修订记录

Document Revision Record

| 版本<br>Version | 日期<br>Date | 描述<br>Description       | 修订人<br>Reviser    |
|---------------|------------|-------------------------|-------------------|
| V1.0          | 2026-08-08 | 初始发行<br>Initial release | 李兴燕<br>Xingyan Li |

## 目录

### CONTENTS

|               |                                      |    |
|---------------|--------------------------------------|----|
| 1. 外形安装图      | <b>External Installation Drawing</b> | 3  |
| 1.1 电机 3D 外观图 | 3D Appearance Diagram of the Motor   | 3  |
| 1.2 电机 2D 安装图 | 2D Installation Diagram of the Motor | 3  |
| 2. 接口定义图      | <b>Interface Definition Diagram</b>  | 5  |
| 2.1 引脚定义      | Pin Definition                       | 5  |
| 3. 规格参数表      | <b>Specification Parameter Table</b> | 7  |
| 4. 特性曲线图      | <b>Characteristic Curve Graph</b>    | 10 |
| 5. 温升表        | <b>Temperature Rise Table</b>        | 11 |
| 6. 扭矩常数曲线图    | <b>Torque Constant Curve Chart</b>   | 12 |

## 1. 外形安装图

### External installation drawing

本节展示了电机的外形结构、安装尺寸。

This section presents the external structure and installation dimensions of the motor.

#### 1.1 电机 3D 外观图

##### 3D appearance diagram of the motor



#### 1.2 电机 2D 安装图

##### 2D Installation diagram of motor

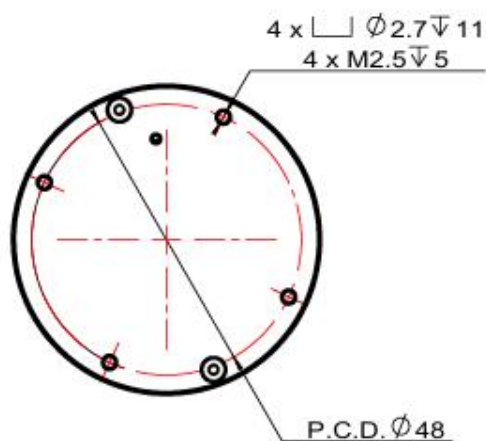


图 1.2 驱动端安装图

Driver end installation diagram

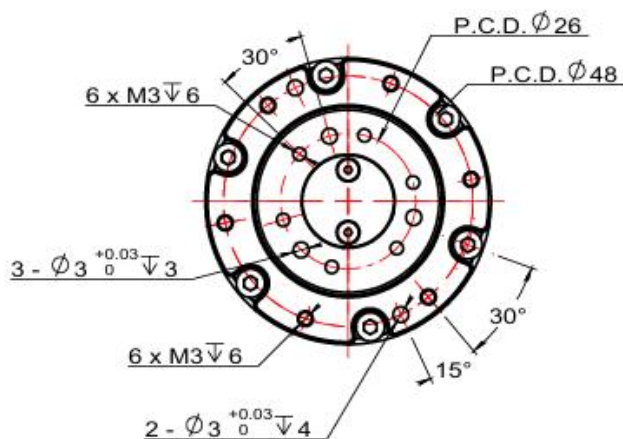


图 1.3 输出端安装图

Output end installation diagram

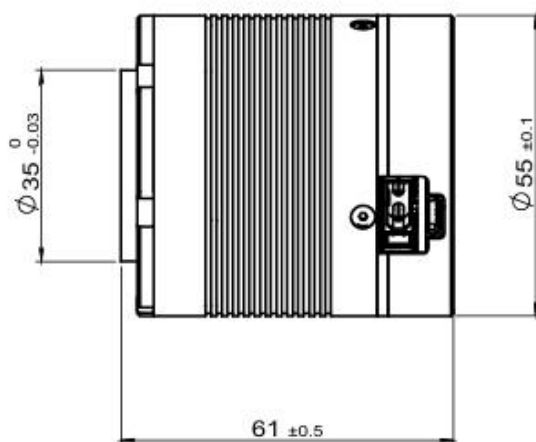


图 1.4 侧视图

Side view

## 2. 接口定义图

### Interface definition diagram

本节展示电机的接口定义，包括电源接口、通信接口及各引脚功能说明。

This section presents the interface definitions of the motor, including the power interface, communication interface, and functional descriptions of each pin.



图 2.1 电机接口定义图

Motor interface definition diagram

### 2.1 引脚定义

#### Pin definition

下表列出了电机各接口引脚的功能定义：

The following table lists the functional definitions of each interface pin of the motor:

| 引脚名称<br>Pin name | 功能描述<br>Function Description | 信号类型<br>Signal type | 备注<br>Note |
|------------------|------------------------------|---------------------|------------|
| VCC              | 电源正极<br>Power Positive       | 电源输入<br>Power Input | 24VDC      |

| 引脚名称<br>Pin name | 功能描述<br>Function Description                  | 信号类型<br>Signal type          | 备注<br>Note                  |
|------------------|-----------------------------------------------|------------------------------|-----------------------------|
| GND              | 电源地<br>Power Ground                           | 电源输入<br>Power Input          | —                           |
| CANH             | CAN 总线高位<br>CAN Bus High                      | 通信信号<br>Communication Signal | 差分信号<br>Differential Signal |
| CANL             | CAN 总线低位<br>CAN Bus Low                       | 通信信号<br>Communication Signal | 差分信号<br>Differential Signal |
| T+/T-            | ECAT 发送差分对<br>ECAT Transmit Differential Pair | 通信信号<br>Communication Signal | 差分信号<br>Differential Signal |
| R+/R-            | ECAT 接收差分对<br>ECAT Receive Differential Pair  | 通信信号<br>Communication Signal | 差分信号<br>Differential Signal |
| PE               | 保护地<br>Protective Earth                       | 接地<br>Ground                 | —                           |

注：ECAT 接口区分输入端和输出端，接口依次标注 IN，OUT。

Note: The ECAT interface distinguishes between the input and output ports. The interface is labeled IN and OUT in sequence.

### 3. 规格参数表

#### Specification Parameter Table

下表列出了电机的详细规格参数，包括电气参数、机械参数及性能指标。

The table below lists the detailed specification parameters of the motor, including electrical parameters, mechanical parameters and performance indicators.

| 序号<br>No. | 参数项<br>Parameter Item          | 单位<br>Unit | RMD-X4-P36-36-E-L |
|-----------|--------------------------------|------------|-------------------|
| 1         | 减速比<br>Reduction Ratio         | -          | 36                |
| 2         | 输入电压<br>Input Voltage          | V          | 24                |
| 3         | 空载转速<br>No-load Speed          | RPM        | 111               |
| 4         | 空载输入电流<br>No-load InputCurrent | A          | 0.9               |
| 5         | 额定转速<br>Rated Speed            | RPM        | 83                |
| 6         | 额定转矩*<br>Rated Torque*         | N · m      | 10.5              |
| 7         | 额定输出功率<br>Rated Output Power   | W          | 100               |
| 8         | 额定相电流<br>Rated Phase Current   | A(rms)     | 6.1               |
|           |                                | A(peak)    | 8.6               |
| 9         | 峰值扭矩*<br>Peak Torque*          | N · m      | 30                |
| 10        | 堵转扭矩<br>Stall Torque           | N · m      | 36                |
| 11        | 堵转相电流<br>Stall Phase Current   | A(rms)     | 21.2              |



| 序号<br>No. | 参数项<br>Parameter Item                   | 单位<br>Unit          | RMD-X4-P36-36-E-L               |
|-----------|-----------------------------------------|---------------------|---------------------------------|
| 12        | 效率<br>Efficiency                        | %                   | 64.7                            |
| 13        | 电机反电势常数<br>Motor Back EMF Constant      | Vdc/Krpm            | 4.3                             |
| 14        | 模组扭矩常数*<br>Module Torque Constant*      | N · m/A(rms)        | 1.8                             |
|           |                                         | N · m/A(peak)       | 1.3                             |
| 15        | 电机线电阻<br>Motor Line Resistance          | $\Omega$            | 0.4                             |
| 16        | 电机线电感<br>Motor Line Inductance          | mH                  | 0.18                            |
| 17        | 极对数<br>Pole Pairs                       | -                   | 11                              |
| 18        | 接线方式<br>Wiring Mode                     | -                   | Y                               |
| 19        | 反驱力矩<br>Backdrive Torque                | N · m               | 0.2                             |
| 20        | 背隙<br>Backlash                          | Arcmin              | 15                              |
| 21        | 输出端轴承型号<br>Output Shaft Bearing Model   | -                   | XRBT 305                        |
| 22        | 轴向载荷 C<br>Axial Load C                  | KN                  | 1.0                             |
| 23        | 径向载荷 Cr<br>Radial Load Cr               | KN                  | 1.3                             |
| 24        | 转动惯量<br>Moment of Inertia               | Kg · m <sup>2</sup> | 0.000082                        |
| 25        | 编码器类型<br>Encoder Type                   | -                   | Dual Encoder ABS<br>17BIT/18BIT |
| 26        | 绝对定位精度<br>Absolute Positioning Accuracy | Degree              | 0.4                             |

| 序号<br>No. | 参数项<br>Parameter Item                 | 单位<br>Unit | RMD-X4-P36-36-E-L |
|-----------|---------------------------------------|------------|-------------------|
| 27        | 重复定位精度<br>Repeat Positioning Accuracy | Degree     | 0.3               |
| 28        | 通信方式<br>Communication Interface       | -          | CAN/EtherCAT      |
| 29        | 重量<br>Weight                          | Kg         | 0.36              |
| 30        | 绝缘等级<br>Insulation Class              | -          | F                 |
| 31        | 尺寸<br>Dimensions                      | mm         | 55×61             |
| 32        | 中空直径<br>Hollow Shaft Diameter         | mm         | /                 |

注：

1. 额定转矩\* 是指电机在额定电压、额定转速条件下，执行正反转 90°摆动并点位维持 5 秒，于最佳效率点邻近区域内可持续输出的扭矩值；
2. 峰值扭矩\*是指电机在额定电压、10rpm 转速下，所输出的最大扭矩值；
3. 上位机所示参数中的 KT\_OUT 基于相电流峰值测试，对应相电流峰值下的模组扭矩常数\*，详情见第 6 节扭矩常数曲线图；
4. 以上额定数据供机器人方向使用，如果自动化行业使用请降低功率。

Note:

1. Rated Torque\* refers to the torque that can be continuously output near the optimal efficiency point when the motor performs 90° forward and reverse swing with 5-second position holding under the conditions of rated voltage and rated speed.
2. Peak Torque\* refers to the maximum torque value that the motor outputs at the rated voltage and 10 rpm speed.
3. KT\_OUT in the parameters displayed on the host computer is tested based on the peak phase current, corresponding to the module torque constant\* at peak phase current. See the torque constant curve diagram in Section 6 for details.
4. The above rated data are for the use of the robot. If used in the automation industry, please reduce the power.

## 4. 特性曲线图

### Characteristic curve graph

本节展示电机的特性曲线关系。

This section presents the characteristic curve relationship of the motor.

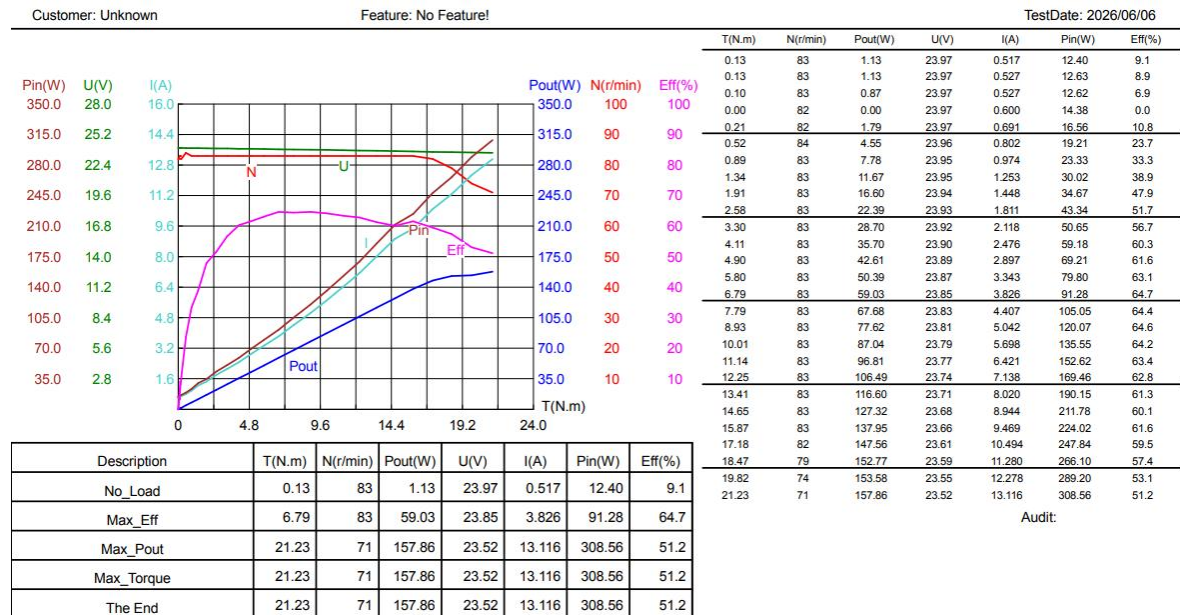


图 4.1 特性曲线图

Characteristic curve graph

## 5. 温升表

### Temperature rise meter

| 转速<br>Speed | 扭矩<br>Torque | 持续时间<br>Duration                   | 电机<br>Motor             |                       | 板载<br>Onboard           |                       |
|-------------|--------------|------------------------------------|-------------------------|-----------------------|-------------------------|-----------------------|
|             |              |                                    | 初始温度 °C<br>Initial Temp | 结束温度 °C<br>Final Temp | 初始温度 °C<br>Initial Temp | 结束温度 °C<br>Final Temp |
| 0 rpm       | 8.5 Nm       | 90' (热平衡)<br>(Thermal Equilibrium) | 27                      | 98                    | 27                      | 90                    |
|             | 10.5 Nm      | 9'11"                              | 26                      | 100                   | 27                      | 82                    |
|             | 21 Nm        | 44"                                | 27                      | 100                   | 27                      | 56                    |
|             | 31.5 Nm      | 7"                                 | 27                      | 100                   | 27                      | 48                    |
|             | 34 Nm        | 2"                                 | 27                      | 100                   | 27                      | 45                    |
| 10 rpm      | 8 Nm         | 90' (热平衡)<br>(Thermal Equilibrium) | 26                      | 94                    | 26                      | 93                    |
|             | 10.5 Nm      | 12'25"                             | 27                      | 100                   | 27                      | 87                    |
|             | 21 Nm        | 36"                                | 27                      | 100                   | 27                      | 57                    |
| 30 rpm      | 8.5 Nm       | 90' (热平衡)<br>(Thermal Equilibrium) | 27                      | 98                    | 27                      | 90                    |
|             | 10.5 Nm      | 8'26"                              | 27                      | 100                   | 27                      | 87                    |
|             | 21 Nm        | 34"                                | 27                      | 100                   | 27                      | 65                    |
| 83 rpm      | 7.5 Nm       | 90' (热平衡)<br>(Thermal Equilibrium) | 26                      | 96                    | 26                      | 94                    |
|             | 10.5 Nm      | 5'26"                              | 27                      | 100                   | 27                      | 89                    |
|             | 15 Nm        | 58"                                | 27                      | 100                   | 27                      | 68                    |

## 6. 扭矩常数曲线图

### Torque Constant Curve Chart

本节通过 IQ 电流法测得扭矩常数值。

In this section, the torque constant values were measured using the IQ current method.

| IQ 电流<br>IQ Current<br>(A_peak) | 实测 1<br>Test 1<br>(N.m) | 实测 2<br>Test 2<br>(N.m) | 实测 3<br>Test 3<br>(N.m) | 实测均值<br>Average<br>Measured<br>Torque<br>(N.m) | 计算值<br>Calculation<br>value | 偏差百分比<br>Deviation<br>percentage | KT_OUT<br>(N.m/A_peak) |
|---------------------------------|-------------------------|-------------------------|-------------------------|------------------------------------------------|-----------------------------|----------------------------------|------------------------|
| 25                              | 31.08                   | 31.08                   | 31.82                   | 31.33                                          | 32.13                       | 2.55%                            | 1.3                    |
| 20                              | 25.64                   | 26.16                   | 26.46                   | 26.09                                          | 25.70                       | -1.48%                           |                        |
| 15                              | 20.40                   | 20.04                   | 20.16                   | 20.20                                          | 19.28                       | -4.58%                           |                        |
| 10                              | 12.54                   | 12.80                   | 13.36                   | 12.90                                          | 12.85                       | -0.39%                           |                        |
| 5                               | 6.20                    | 6.84                    | 6.68                    | 6.57                                           | 6.43                        | -2.26%                           |                        |
| -5                              | -6.32                   | -6.46                   | -6.56                   | -6.45                                          | -6.43                       | -0.34%                           |                        |
| -10                             | -12.18                  | -12.66                  | -13.16                  | -12.67                                         | -12.85                      | 1.45%                            |                        |
| -15                             | -19.34                  | -20.14                  | -20.62                  | -20.03                                         | -19.28                      | -3.79%                           |                        |
| -20                             | -25.84                  | -26.46                  | -26.42                  | -26.24                                         | -25.70                      | -2.06%                           |                        |
| -25                             | -31.08                  | -31.48                  | -31.06                  | -31.21                                         | -32.13                      | 2.94%                            |                        |

$KT\_OUT = \frac{\sum[(IQ \text{ 电流} - IQ \text{ 电流的平均值})(\text{实测均值} - \text{实测均值的平均值})]}{\sum[(IQ \text{ 电流} - IQ \text{ 电流的平均值})^2]}$

$KT\_OUT = \frac{\sum[(IQ \text{ current} - \text{average of IQ current})(\text{measured torque} - \text{average of measured torque})]}{\sum[(IQ \text{ current} - \text{average of IQ current})^2]}$

偏差百分比 = (计算值 - 实测均值) / 实测均值

Percentage Deviation = (Calculated Value - Average Measured Value) / Average Measured Value

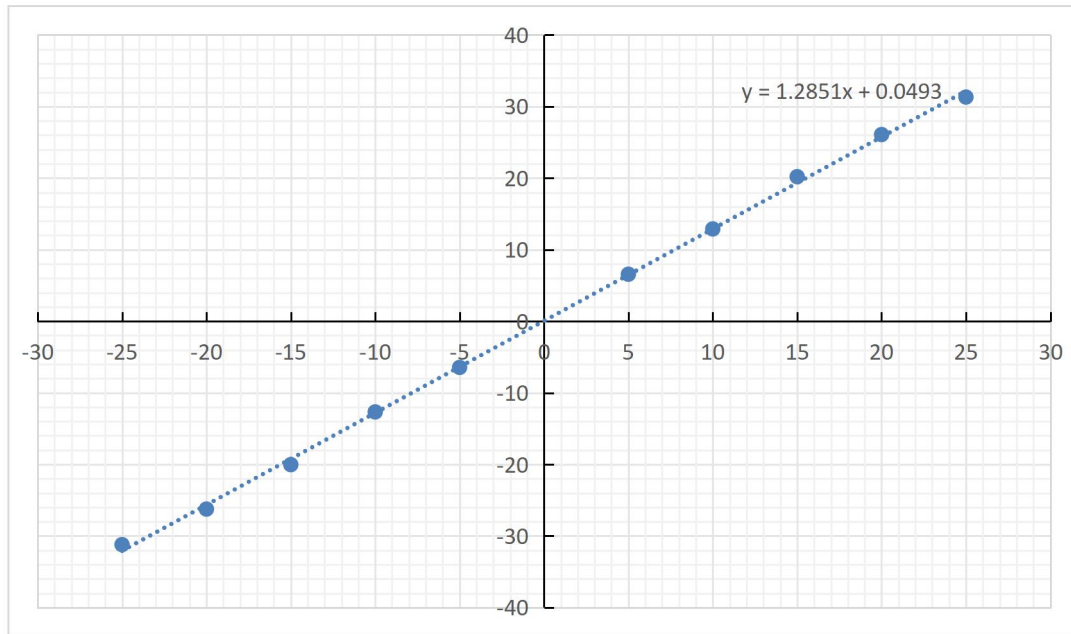


图 6.1 扭矩常数曲线图  
Torque constant curve graph