# 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-P12-10-E-L |
| 文档版本/Version | V1.1 |
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# 文档修订记录

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| V1.1 | 2026-11-3 | 修订图 1.3 输出端安装图尺寸（法兰盖板 3mm 销孔深度由 4 更新为 3.5；M3 螺纹孔深度由 5 更新为 4.2）<br>Revised dimensions in Figure 1.3 Output end Installation Drawing (Flange cover 3mm pin hole depth updated from 4 to 3.5; M3 threaded hole depth updated from 5 to 4.2) | 李兴燕<br>Xingyan Li |

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# 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




*图 1.1 外观图*

*External view*

## 1.2 电机 2D 安装图

## 2D Installation diagram of motor

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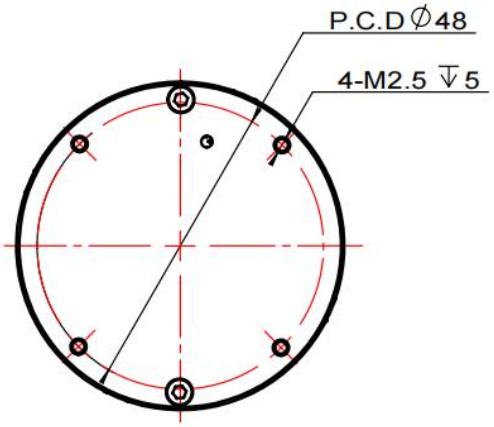



图 1.2 驱动端安装图

Driver end installation diagram

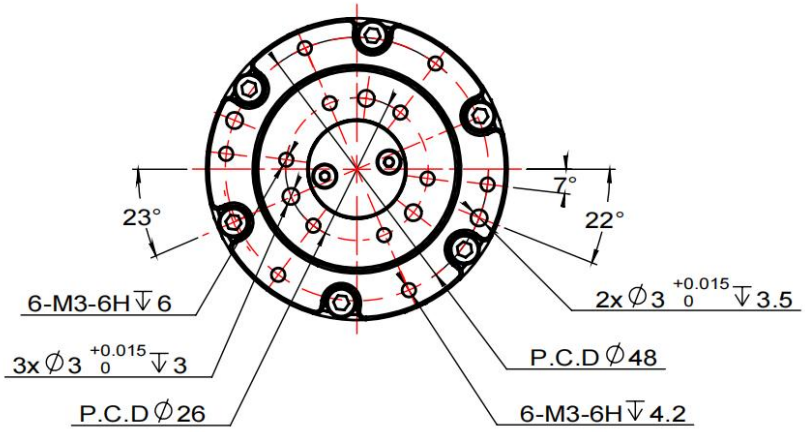



图 1.3 输出端安装图

Output end installation diagram

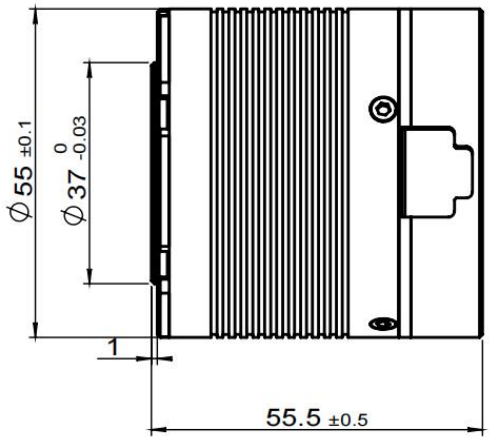



图 1.4 侧视图

Side view

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# 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:

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| 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 |
| 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.

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# 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-P12-10-E-L |
|---|---|---|---|
| 1 | 减速比<br>Reduction Ratio | - | 12.5 |
| 2 | 输入电压<br>Input Voltage | V | 24 |
| 3 | 空载转速<br>No-load Speed | RPM | 317 |
| 4 | 空载输入电流<br>No-load Input Current | A | 1 |
| 5 | 额定转速<br>Rated Speed | RPM | 238 |
| 6 | 额定转矩*<br>Rated Torque* | N · m | 4 |
| 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) | 7.8 |
| | | A(peak) | 11 |
| 9 | 峰值扭矩*<br>Peak Torque* | N · m | 11 |
| 10 | 堵转扭矩<br>Stall Torque | N · m | 12 |
| 11 | 堵转相电流<br>Stall Phase Current | A(rms) | 21.2 |

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| 序号<br>No. | 参数项<br>Parameter Item | 单位<br>Unit | RMD-X4-P12-10-E-L |
|---|---|---|---|
| 12 | 效率<br>Efficiency | % | 69 |
| 13 | 电机反电势常数<br>Motor Back EMF Constant | Vdc/Krpm | 5 |
| 14 | 模组扭矩常数*<br>Module Torque Constant* | N · m/A(rms) | 0.62 |
| | | N · m/A(peak) | 0.44 |
| 15 | 电机线电阻<br>Motor Line Resistance | Ω | 0.207 |
| 16 | 电机线电感<br>Motor Line Inductance | mH | 0.037 |
| 17 | 极对数<br>Pole Pairs | - | 11 |
| 18 | 接线方式<br>Wiring Mode | - | Y |
| 19 | 反驱力矩<br>Back drive 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 | - | 6707-ZZ |
| 22 | 轴向载荷 C<br>Axial Load C | KN | / |
| 23 | 径向载荷 Cr<br>Radial Load Cr | KN | / |
| 24 | 转动惯量<br>Moment of Inertia | $Kg \cdot m^2$ | 0.000022 |
| 25 | 编码器类型<br>Encoder Type | - | Dual Encoder<br>ABS-17BIT/ABS-18BIT |
| 26 | 绝对定位精度<br>Absolute Positioning Accuracy | Degree | 0.4 |

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| 序号<br>No. | 参数项<br>Parameter Item | 单位<br>Unit | RMD-X4-P12-10-E-L |
|---|---|---|---|
| 27 | 重复定位精度<br>Repeat Positioning Accuracy | Degree | 0.7 |
| 28 | 通信方式<br>Communication Interface | - | CAN/EtherCAT |
| 29 | 重量<br>Weight | Kg | 0.33 |
| 30 | 绝缘等级<br>Insulation Class | - | F |
| 31 | 尺寸<br>Dimensions | mm | 55×55.5 |
| 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.

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# 4. 特性曲线图

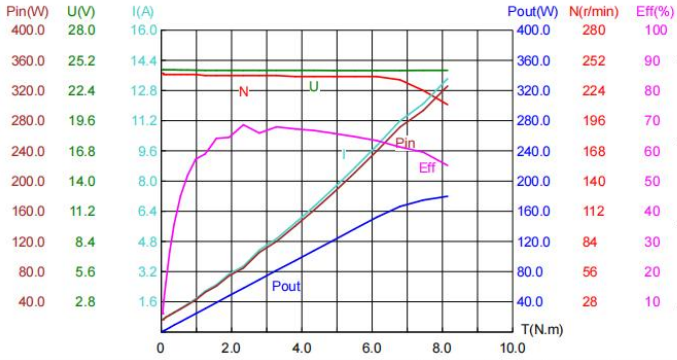
## Characteristic curve graph

本节展示电机的特性曲线关系。

This section presents the characteristic curve relationship of the motor.

型号: X4-P12.5-10　　额定电压: 24.0(V)

客户名称: Unknown　　特征说明: No Feature!　　测试日期: 2026年08月27日




| T(N.m) | N(r/min) | Pout(W) | U(V) | I(A) | Pin(W) | Eff(%) |
|---|---|---|---|---|---|---|
| 0.04 | 240 | 1.00 | 24.32 | 0.678 | 16.50 | 6.1 |
| 0.04 | 240 | 1.00 | 24.32 | 0.677 | 16.47 | 6.1 |
| 0.07 | 239 | 1.75 | 24.32 | 0.701 | 17.04 | 10.3 |
| 0.13 | 239 | 3.25 | 24.32 | 0.807 | 19.64 | 16.6 |
| 0.24 | 239 | 6.00 | 24.32 | 0.920 | 22.36 | 26.8 |
| 0.37 | 239 | 9.26 | 24.32 | 1.062 | 25.84 | 35.8 |
| 0.55 | 239 | 13.76 | 24.31 | 1.254 | 30.48 | 45.1 |
| 0.75 | 239 | 18.76 | 24.31 | 1.486 | 36.13 | 51.9 |
| 0.98 | 239 | 24.51 | 24.30 | 1.760 | 42.76 | 57.3 |
| 1.25 | 238 | 31.14 | 24.27 | 2.174 | 52.75 | 59.0 |
| 1.57 | 238 | 39.11 | 24.27 | 2.512 | 60.96 | 64.2 |
| 1.93 | 238 | 48.07 | 24.27 | 3.071 | 74.54 | 64.5 |
| 2.34 | 238 | 58.29 | 24.27 | 3.496 | 84.86 | 68.7 |
| 2.79 | 238 | 69.50 | 24.27 | 4.345 | 105.45 | 65.9 |
| 3.28 | 238 | 81.70 | 24.27 | 4.950 | 120.15 | 68.0 |
| 3.81 | 237 | 94.50 | 24.27 | 5.785 | 140.39 | 67.3 |
| 4.35 | 237 | 107.90 | 24.27 | 6.660 | 161.64 | 66.8 |
| 4.91 | 237 | 121.79 | 24.26 | 7.622 | 185.00 | 65.8 |
| 5.51 | 237 | 136.67 | 24.26 | 8.701 | 211.18 | 64.7 |
| 6.14 | 237 | 152.30 | 24.26 | 9.893 | 240.11 | 63.4 |
| 6.80 | 234 | 166.54 | 24.26 | 11.195 | 271.69 | 61.3 |
| 7.46 | 224 | 174.89 | 24.27 | 12.096 | 293.57 | 59.6 |
| 8.15 | 211 | 179.98 | 24.27 | 13.430 | 325.95 | 55.2 |

检验审核:

| 项目 | T(N.m) | N(r/min) | Pout(W) | U(V) | I(A) | Pin(W) | Eff(%) |
|---|---|---|---|---|---|---|---|
| 不加载点(No_Load) | 0.04 | 240 | 1.00 | 24.32 | 0.678 | 16.50 | 6.1 |
| 最高效率点(Max_Eff) | 2.34 | 238 | 58.29 | 24.27 | 3.496 | 84.86 | 68.7 |
| 最大输出功率点(Max_Pout) | 8.15 | 211 | 179.98 | 24.27 | 13.430 | 325.95 | 55.2 |
| 最大转矩点(Max_Torque) | 8.15 | 211 | 179.98 | 24.27 | 13.430 | 325.95 | 55.2 |
| 结束(The End) | 8.15 | 211 | 179.98 | 24.27 | 13.430 | 325.95 | 55.2 |
| 效率平台 | 26.55 | 287 | 798.71 | 24.50 | -40.746 | -998.39 | -80.0 |
| | 1.32 | 243 | 33.67 | 24.32 | -1.731 | -42.08 | -80.0 |

*图 4.1 特性曲线图*

*Characteristic curve graph*

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# 5. 温升表

## Temperature rise meter

| 转速 Speed | 扭矩 Torque | 持续时间 Duration | 电机 Motor | | 板载 Onboard | |
|---|---|---|---|---|---|---|
| | | | 初始温度 ℃ Initial Temp | 结束温度 ℃ Final Temp | 初始温度 ℃ Initial Temp | 结束温度 ℃ Final Temp |
| 0 rpm | 2.9 Nm | 90′（热平衡） (Thermal Equilibrium) | 27 | 96 | 27 | 76 |
| | 4 Nm | 2′15″ | 26 | 100 | 27 | 57 |
| | 8 Nm | 10″ | 27 | 100 | 27 | 42 |
| | 10 Nm | 7″ | 27 | 100 | 27 | 44 |
| 10 rpm | 2.8 Nm | 90′（热平衡） (Thermal Equilibrium) | 26 | 95 | 26 | 80 |
| | 4 Nm | 4′20″ | 27 | 100 | 27 | 71 |
| | 8 Nm | 16″ | 27 | 100 | 27 | 42 |
| 30 rpm | 2.8 Nm | 90′（热平衡） (Thermal Equilibrium) | 27 | 97 | 27 | 83 |
| | 4 Nm | 4′7″ | 27 | 100 | 27 | 72 |
| | 8 Nm | 19″ | 27 | 100 | 27 | 42 |
| 238 rpm | 2 Nm | 90′（热平衡） (Thermal Equilibrium) | 26 | 96 | 26 | 85 |
| | 4 Nm | 2′13″ | 27 | 100 | 27 | 68 |
| | 6 Nm | 35″ | 27 | 100 | 27 | 50 |

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# 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 IQ Current (A_peak) | 实测 1 Test 1 (N.m) | 实测 2 Test 2 (N.m) | 实测 3 Test 3 (N.m) | 实测均值 Average Measured Torque (N.m) | 计算值 Calculation value | 偏差百分比 Deviation percentage | KT_OUT (N.m/A_peak) |
|---|---|---|---|---|---|---|---|
| 25 | 10.45 | 10.14 | 10.29 | 10.29 | 11 | 6.87% | 0.44 |
| 20 | 8.58 | 8.67 | 9.06 | 8.77 | 8.8 | 0.34% | |
| 15 | 6.91 | 6.98 | 6.86 | 6.92 | 6.6 | -4.58% | |
| 10 | 4.65 | 4.64 | 4.59 | 4.63 | 4.4 | -4.90% | |
| 5 | 2.37 | 2.24 | 2.26 | 2.29 | 2.2 | -3.93% | |
| -5 | -2.44 | -2.42 | -2.32 | -2.39 | -2.2 | -8.08% | |
| -10 | -4.8 | -4.77 | -4.95 | -4.84 | -4.4 | -9.09% | |
| -15 | -7.22 | -6.9 | -6.98 | -7.03 | -6.6 | -6.16% | |
| -20 | -9.27 | -8.94 | -9.09 | -9.10 | -8.8 | -3.30% | |
| -25 | -11.3 | -10.78 | -11.61 | -11.23 | -11 | -2.05% | |

KT_OUT=Σ[(IQ 电流 -IQ 电流的平均值)(实测均值 - 实测均值的平均值)] / Σ[(IQ 电流 -IQ 电流的平均值)²]。

KT_OUT=∑[(IQ current-average of IQ current)(measured torque−average of measured torque)] / ∑[(IQ current−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

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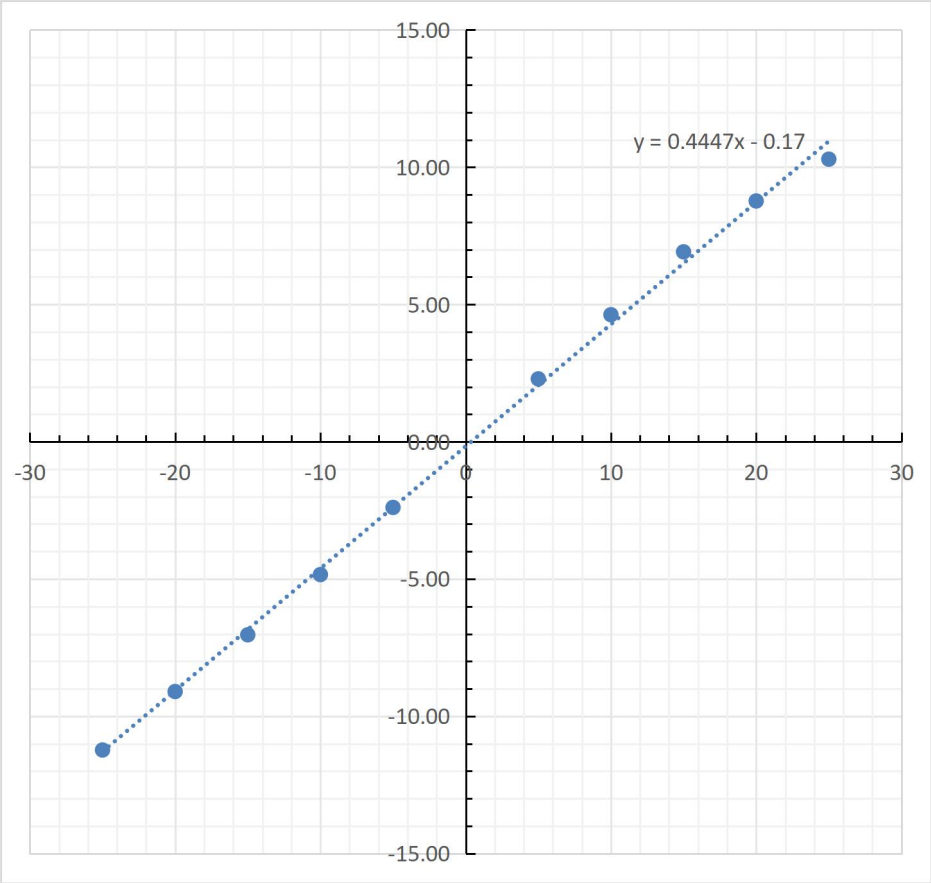



*图 6.1 扭矩常数曲线图*

*Torque constant curve graph*

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