BONENG

X3000系列运动控制器

X3000 Series Motion Controller



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BONENG

Boneng Transmission



控制器/驱动器/马达/
齿轮马达/齿轮箱

Controller/ Drive/ Motor/
Gearmotor/ Gearbox

目 录 Contents

1 概述 …… 01
2 产品特色 …… 02
2.1 用户友好,易于使用 …… 02
2.2 结构紧凑,灵活配置 …… 03
2.3 性能卓越,功能丰富 …… 04
3 控制器应用行业及主机 …… 07
4 选型及订货号 …… 08
4.1 CPU模块 …… 08
4.2 本地扩展IO模块 …… 08
5 技术数据 …… 09
5.1 CPU模块技术数据 …… 09
5.2 扩展模块技术数据 …… 10
6 外形尺寸及安装 …… 11

1 Overview …… 01
2 Product Features …… 02
2.1 User-Friendliness, Easy to Use …… 02
2.2 Compact,Flexible Configuration …… 03
2.3 Excellent Performance, Abundant Function …… 04
3 Controller application industry and host …… 07
4 Model Selection And Order Number …… 08
4.1 CPU Module …… 08
4.2 Local Extension I/O Module …… 08
5 Technical Data …… 09
5.1 Technical Data of CPU Module …… 09
5.2 Technical Data of Extension Module …… 10
6 Shape And Size of The Installation …… 11

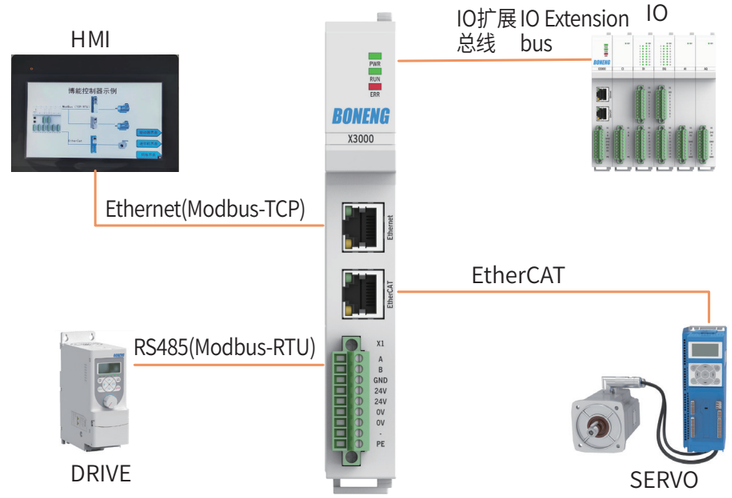
1 概述

X3000系列运动控制器是博能自主开发的支持5种PLCopen标准语言的智能模块化控制器，此系列控制器支持一路EtherCAT主站，一路Modbus-TCP主从站，2路Modbus-RTU主从站，及最大1+15个本地扩展IO模块，最大数字量IO点数为240点，最大模拟量通道为60路，模块化本地扩展IO有DI，DQ，AI，AQ，CI五种类型，可满足大部分自动化设备及过程控制的需要。

1 Overview

X3000 Series Motion Controller is an intelligent modular controller independently developed by Boneng that supports 5 PLCopen standard languages,This controller supports one EtherCAT master station，One Modbus-TCP master/slave station, two Modbus-RTU master/slave stations, and a maximum of 1+15 local expansion IO modules，the maximum number of digital IO points is 240, the maximum analog channel is 60, modular local extension IO has DI, DQ, AI, AQ, CI five types, can meet most of the automation equipment and process control needs.

		X3050
PLC基本功能	Basic functions of PLC	√
最小扫描周期	Minimum scanning period	1ms
EtherCAT	EtherCAT	√
Modbus	Modbus	√
Ethernet	Ethernet	√
最大EtherCAT轴数	Maximum number of EtherCAT axis	32
本体IO	The number of IO on the CPU module	0
最大本地扩展IO	Maximum number of local expansion IO	240
速度控制	Speed control	√
扭矩控制	Torque control	√
定位控制	Position control	√
PID控制器	PID controler	√
MC标准功能块	MC Standard Function Block	√
编码器轴	Encoder axis	√
虚拟编码器轴	Virtual encoder axis	√
伺服轴	Servo axis	√
虚拟轴	Virtual axis	√
电子齿轮同步	Electronic gear synchronization	√
电子凸轮同步	Electronic cam synchronization	√
轴组(点到点运动)	Group of Axes(PTP)	√
轴组(空间直线插补)	Group of Axes(Spatial linear interpolation)	√
轴组(空间圆弧插补)	Group of Axes(Spatial arc interpolation)	√
轴组(龙门主从同步)	Group of Axes(Gantry master-slave synchronization)	√
轴组(姿态控制)	Group of Axes(posture control)	√



X3000系列控制器接口说明

Description of ports on the X3000 series controllers

2 产品特色

2.1 用户友好，易于使用

◆ 控制器开发软件小巧，安装及使用快捷，轻松上手

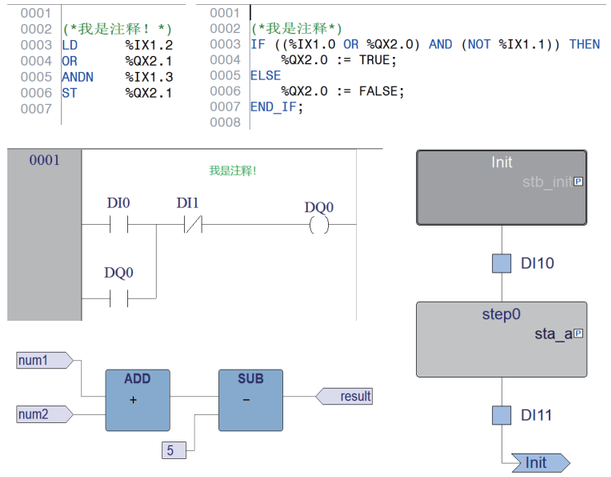
◆ 支持LD，ST，FBD，SFC，IL五种PLCopen标准编程语言，符合IEC61131-3标准

2 Product Features

2.1 User-Friendliness, Easy to Use

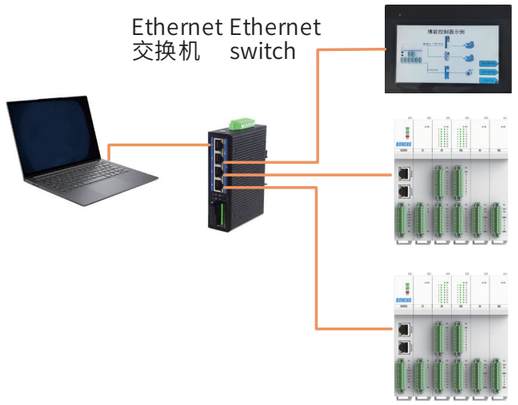
◆ The controller development software is small, easy to install and use

◆ Support LD, ST, FBD, SFC, IL five PLCopen standard programming languages, in line with IEC61131-3 standard



◆支持Ethernet接口编程，无需专用编程器，调试速度快，易于使用

◆Support Ethernet interface programming, no special programmer, debugging speed is fast, easy to use



X3000系列控制器调试网络拓扑

X3000 series controller to debug the network topology

2.2 结构紧凑，灵活配置

◆书本型窄体设计，结构紧凑，节省安装空间

◆支持模块化本地IO扩展，灵活配置，最多可支持1+15个IO扩展

2.2 Compact,Flexible Configuration

◆Book type narrow body design, compact structure, save installation space.

◆Support modular local I/O expansion, flexible configuration, up to 1+15 I/O expansion.



2.3 性能卓越，功能丰富

◆支持EtherCAT主站

◆EtherCAT主站支持PP单轴定位控制，多轴MC定位控制

◆支持2路Modbus-RTU主从站

◆支持一路Modbus-TCP主从站

◆支持虚拟轴，编码器轴，总线伺服轴

◆支持齿轮同步，凸轮同步功能

◆支持轴组运动

2.3 Excellent Performance, Abundant Function

◆Support EtherCAT master station.

◆EtherCAT master station supports PP uniaxial positioning control, Multi-axis MC position control.

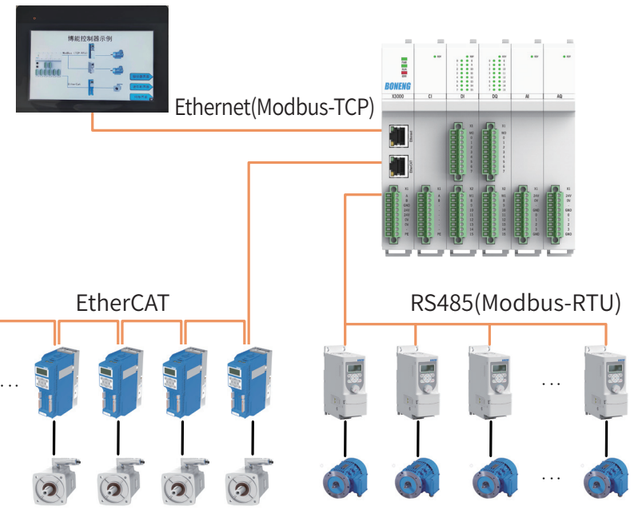
◆Supports two modbus-RTU master and slave stations

◆Supports one Modbus-TCP master/slave station

◆Support virtual axis, encoder axis, and bus servo axis

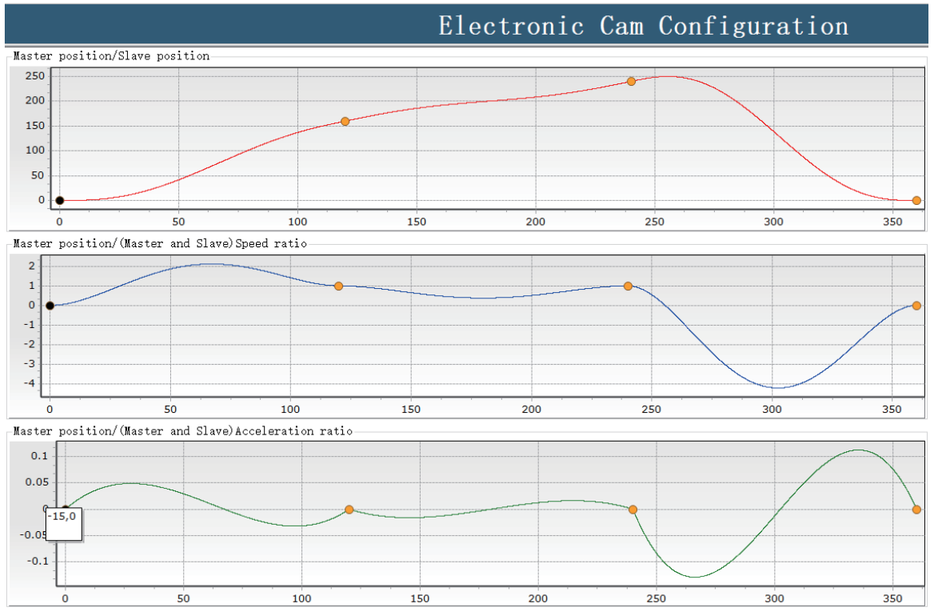
◆Support gear synchronization and cam synchronization

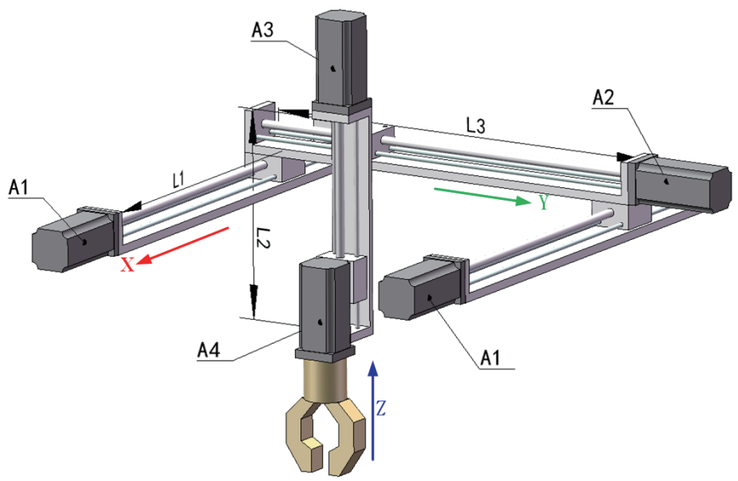
◆Support axes group motion

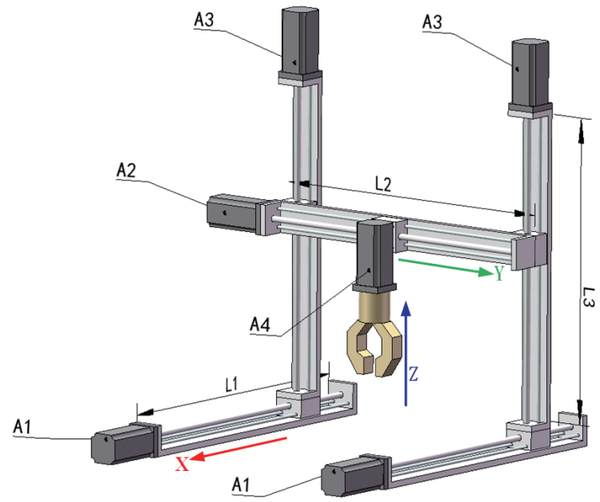


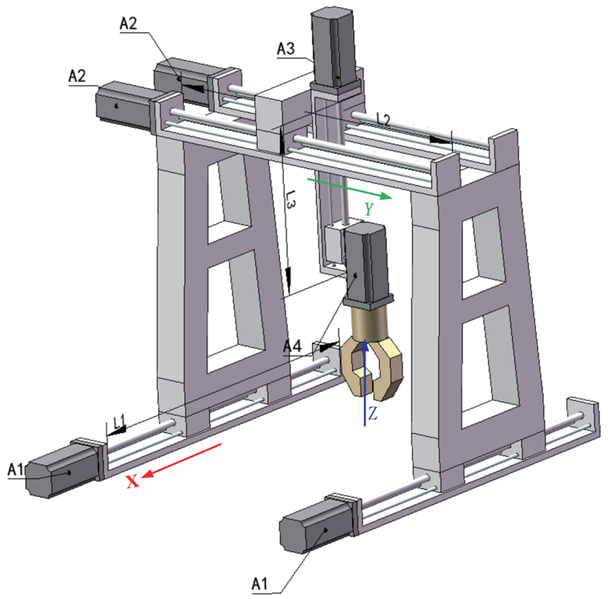
X3000系列控制器典型配置拓扑

Typical configuration topology of X3000 series controllers


Electronic Cam Configuration
Master position/Slave position
250
200
150
100
50
0
0
50
100
150
200
250
300
350
Master position/(Master and Slave)Speed ratio
2
1
0
-1
-2
-3
-4
0
50
100
150
200
250
300
350
Master position/(Master and Slave)Acceleration ratio
0.1
0.05
0
-0.05
-0.1
-15,0
0
50
100
150
200
250
300
350


A3
A2
L3
A1
L1
Y
L2
X
A4
A1
Z


A3
A3
A2
L2
Y
L3
A4
Z
L1
A1
X
A1


A2
A3
A2
L2
L3
Y
A4
Z
L1
A1
X
A1

3 控制器应用行业及主机　3 Controller application industry and host

X3050					
调速	speed	定位	position	同步/凸轮/轴组	synchronous/CAM/Group
行车	crane	装箱机	case packer	凹版印刷机	concave-printing machine
门机	door crane	码垛机	palletizer	复合机	laminator
塔机	tower crane	裹包机	wrapping machine	涂布机	coater
拉丝机	Drawbench	叠片机	Laminating machine	复卷机	rewinder
升降机	hoist	串焊机	string welding machine	分切机	slitter
输送机	conveyor	封口机	sealing machine	压花机	embossing machine
辊压机	roller press	桁架	truss	印花机	printing machine
卷板机	veneer reeling machine	伺服转台	servo turntable	拉幅定型机	tensioning machine
搅拌机	mixer	冲压机	punching machine	浆纱机	slasher
		焊接机	welding machine	纺纱机	Spinning machine
		堆垛机	stacker	倍捻机	twister
				着色机	coloring machine
				多线切割机	multi-wire saw
				灌装机	filling machine
				旋盖机	capper
				贴标机	labeller
				装箱机	case packer
				折弯机/弯管机	bending machine
				剪板机	clipper
				成型机	forming machine
				轮切/飞锯	fly saw
				追剪	fly shear
				点胶机	Gluing machine
				桁架机器人	Truss robot
				龙门机床	Gantry machine tool
				智能行车	Intelligent bridge crane

4 选型及订货号　4 Selection ordering data

4.1 CPU模块　4.1 CPU Module

博能X3000系列运动控制器CPU模块订货号如下。

The ordering numbers for the CPU modules of the Boneng X3000 series motion controllers are as follows.

订货号 Order Number	描述	Description
X3050-EC-00-S	支持Ethercat单轴、多轴定位，速度控制，多轴同步，轴组	Supports EtherCAT single-axis and multi-axis positioning, speed control, multi-axis synchronization, and axis groups

4.2 本地扩展IO模块　4.2 Local expansion IO module

博能X3000系列本地扩展IO总共有5种类型，其中Modbus通讯模块最多扩展1个，建议安装在最靠近CPU的右侧位置。其他DI，DQ，AI，AQ模块最多支持15个，可灵活选择配置及个数。

There are five types of local expansion IO module of Boneng X3000 series, of which the Modbus communication module can be expanded by up to one. It is recommended to install it on the right side closest to the CPU. Other DI, DQ, AI, AQ modules can support up to 15, and the configuration and number can be flexibly selected

订货号 Order Number	描述	Description
X3000-DI-16-1	数字量输入模块,16点输入,24VDC	Digital input module,16 point input,24VDC
X3000-DQ-16-3	数字量输出模块,16点输出,继电器	Digital output module,16 point relay output
X3000-AI-04-3	模拟量输入模块,4通道输入,电压/电流	Analog input module,4-channel voltage/current input
X3000-AQ-04-1	模拟量输出模块,4通道输出,电压	Analog output module,4-channel voltage output
X3000-CI-01-1	通讯接口模块,1通道Modbus接口	Communication interface module,1-channel Modbus interface

5 技术数据

5 Technical parameters

5.1 CPU模块技术数据

5.1 CPU Module technical parameters

运算能力	Computational ability	CPU	CPU	ARM-A8 800MHz	ARM-A8 800MHz
		最小循环周期	Minimum cycle	1ms	1ms
		PLC基本指令速度	PLC basic command speed	0.013us	0.013us
存储	Storage	用户程序容量	User program capacity	1MB	1MB
		用户数据空间	User data space	8MB	8MB
		掉电保存空间	Power-down retaining space	4kB	4kB
工作电源	Working power supply	外部端子供电	External terminal power supply	• 电压：DC19.2…28.8V • 电流：额定0.35A，最大2.6A	• Voltage：DC19.2…28.8V • Current: rated 0.35A, maximum 2.6A
通讯接口	Communication interface	EtherCAT	EtherCAT	1个RJ45端口	One RJ45 interface
		Ethernet	Ethernet	1个RJ45端口	One RJ45 interface
		Modbus	Modbus	无内置端接电阻	No built-in termination resistor
日时钟	Daily clock	断电维持一周	Power off for one week		
编程语言	Programing language	LD	LD	√	√
		ST	ST	√	√
		IL	IL	√	√
		FBD	FBD	√	√
		SFC	SFC	√	√
扩展数量	Expanded quantity	最大1+15个，Modbus扩展模块最多只允许扩展一个，其他类型最多15个	The maximum number is 1+15. Only one Modbus expansion module can be expanded at most, and the maximum number of other types is 15		
工作温度	Working temperature	-20℃~+50℃	-20℃~+50℃		
存储温度	Storage temperature	-40℃~+70℃	-40℃~+70℃		
相对空气湿度	Relative air humidity	<95%	<95%	不允许有凝露	No condensation is allowed
污染	Pollution level	符合IEC 61800-5-1	Conform IEC 61800-5-1	适用于污染等级2的环境	Suitable for environment with pollution level 2
电磁兼容性	Electromagnetic compatibility	符合IEC 61800-3	Conform IEC 61800-3		
防护等级	IP Grade	IP20	IP20		
重量	Weight	230g	230g		

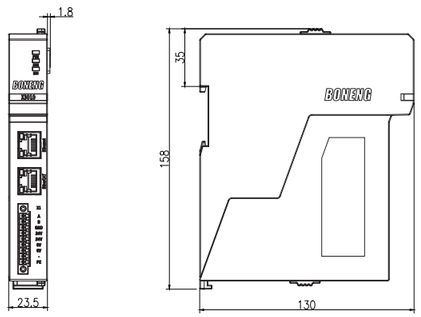
5.2 扩展模块技术数据

5.2 Local expansion IO module technical parameters

通用数据	General data	工作温度	Working temperature	• -20℃~+50℃	• -20℃~+50℃
		存储温度	Storage temperature	• -40℃~+70℃	• -40℃~+70℃
		相对空气湿度	Relative air humidity	• <95%，不允许有凝露	• <95%，No condensation is allowed
		污染	Pollution level	• 符合IEC61800-5-1，适用于污染等级2的环境	• Conform to IEC61800-5-1, Suitable for environment with pollution level 2
		电磁兼容性	Electromagnetic compatibility	• 符合IEC61800-3	• Conform to IEC61800-3
		防护等级	IP Grade	• IP20	• IP20
数字量输入模块 X3000-DI-16-1	Digital input module	16个点 16 point		• 模块电源：CPU模块提供，DC24V±20%/max.50mA	• Module power supply: provided by CPU module DC24V±20%/max.50mA
				• 电压：DC24V	• Voltage:DC24V
				• 支持Source和Sink模式	• Support Source and Sink modes
				• "1"信号电压：>11V，"0"信号电压：<5V	• "1"Signal voltage:>11V, "0"Signal voltage:<5V
				• 24V典型电流：4mA	• 24VTypical current:4mA
数字量输出模块 X3000-DQ-16-3	Digital output module	16个点 16 point		• 模块电源：CPU模块提供，DC24V±20%/max.150mA	• Module power supply: provided by CPU module DC24V±20%/max.150mA
				• 继电器类型	• Relay type
				• 电压:DC24V、AC36V、AC48V	• Voltage:DC24V、AC36V、AC48V
				• 连续电流：最大2A，公共端最大8A	• Continuous current:max.2A, max.8A at common terminal
				• 切换电流：最大2A，公共端最大8A	• Switching current:max.2A, max.8A at common terminal
				• 触点类型：常开	• Contact type: normally open contact
模拟量输入模块 X3000-AI-04-3	Analog input module	4个通道4-channel		• 模块电源：端子提供，DC24V±20%/max.50mA	• Module power supply:provided by terminal,DC24V±20%/max.50mA
				• 单端输入，共GND	• Single ended input, total GND
				• 程序切换电压和电流模式	• Program switches voltage and current modes
				• 电压型支持0V…10V	• Voltage type supports 0V…10V
				• 电流型支持0mA…20mA、4mA…20mA	• Current type supports 0mA…20mA、4mA…20mA
				• 电流型内阻250Ω	• Current type internal resistance250Ω
				• 精度：±1%,12位采样精度	• Precision:±1%,12 bit sampling precision
模拟量输出模块 X3000-AQ-04-1	Analog output module	4个通道4-channel		• 模块电源：端子提供，DC24V±20%/max.50mA	• Module power supply: provided by CPU moduleDC24V±20%/max.50mA
				• 单端输入，共GND	• Single ended input,total GND
				• 电压型支持0V…10V	• Voltage type supports 0V…10V
				• 电压型负载电阻需大于5kΩ	• Voltage type load resistance shall be greater than5kΩ
				• 精度：±1%	• Precision:±1%
通讯模块 X3000-CI-01-1	Communication interface module	1个通道1-channel		• 模块电源：CPU模块提供，DC24V±20%/max.10mA	• Module power supply: provided by CPU module DC24V±20%/max.10mA
				• 支持Modbus-RTU	• Support
				• 波特率：最大115200bps	• Baud rate:115200bps maximum
				• 无板载终端电阻	• No board terminal resistance

6 外形尺寸及安装

模块外形及安装尺寸如下图所示，实际安装时，模块上下方至少有50mm的空间，利于安装、散热及接线。

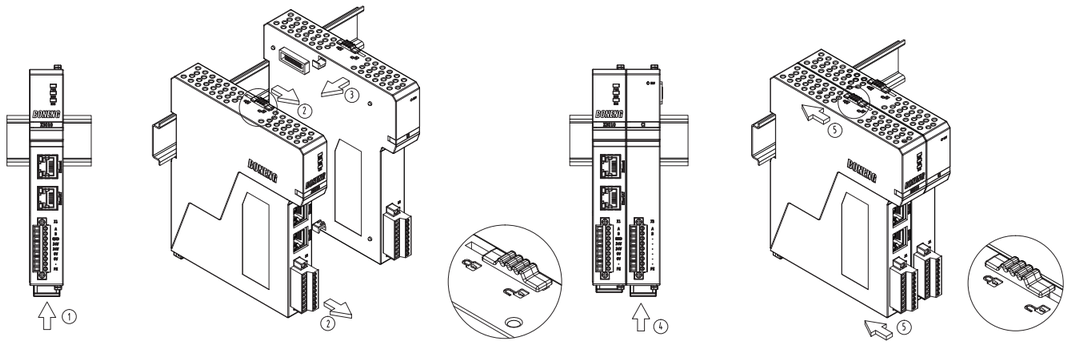


使用标准的35mm宽DIN导轨安装，将CPU安装至导轨上正确位置，底部的卡接滑块向上推使其固定。扩展模块对接完成后，上推卡接滑块使其固定，并将其左侧模块的上方和下方固定锁扣拨至锁定状态。

6 Overall Dimension and Installation

The shape and size of the module are shown in the figure below. During the actual installation, there is at least 50mm space above and below the module to facilitate installation, cooling and wiring.

Use the standard 35mm wide DIN rail installation, install the CPU to the correct position on the rail, push up the splice slider at the bottom to fix it, push up the splice slider of extension module to fix it after the extension module docking is completed, and push up the fix lock on the top and bottom of the left module to lock it.



随着技术迭代进步，博能产品样本将会同步更新，请见谅。
Along with the technology advancedet.,the product of the manual of Boneng will be changed,please forgive.

控制层 CONTROL

驱动层 DRIVE

马达层 MOTOR

齿轮层 GEAR



X7030 X7050
系列控制器
EtherCAT&Modbus



X3050 运动控制器
Motion Controller
EtherCAT&Modbus
24VDC

C/F/K/S-M
*· · ·D
马达分布式
变频驱动器
Integrated
Gearmotor
Drive











EtherCAT&
Modbus
380~480VAC
0.25~3kW
i=4~355

AM 变频驱动器
Variable Frequency Drive



Modbus
380~480VAC
0.75~5.5kW

A1 变频驱动器
Variable Frequency Drive



Modbus/CANopen
/PROFINET
380~480VAC
0.75~250kW

C/F/K/S/R
齿轮马达
Gearmotor











380~480VAC
0.09~200kW
i=1.25~500

MP/MU
三相交流异步马达
AsynchronousMotor



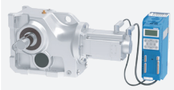
380~480VAC
0.09~90kW
960/1450r/min
1160/1750r/min

MX&AX
伺服马达&伺
服驱动器
Permanent
Magnet
Servo Motor
&Servo Drive

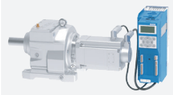


EtherCAT/
PROFINET
380~480VAC
0.28~14kW
1500/2000r/min
3000/4500r/min

C/F/K-MX
&AX齿轮伺
服马达&伺
服驱动器
Servo
Gearmotor
&Servo Drive







EtherCAT/
PROFINET
380~480VAC
0.28~14kW
i=1.25~315

PX-MX&AX
行星伺服马达
&伺服驱动器
Planetary
Precision Gear
Servo Motor
&Servo Drive





EtherCAT/
PROFINET
380~480VAC
0.38~14kW
i=3~100

PN-MN&AN
行星伺服马达
&伺服驱动器
Planetary
Precision Gear
Servo Motor
&Servo Drive







EtherCAT
PROFINET
380~480VAC
0.28~5.03kW
i=3~100

ME&AN
永磁同步伺服马
达&伺服驱动器
Permanent
Magnet
Servo Motor
&Servo Drive



EtherCAT/
PROFINET
200~240VAC
0.1kW~7.5kW

HB/BE/HK
齿轮箱
Gearbox



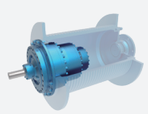
4.2~15775kW
i=5.6~450

P/PK
行星齿轮箱
Planetary
Gearbox



0.4~14000kW
i=25~4000

PW
卷扬齿轮箱
Planetary
Winch
Gearbox



1~1810kW
i=13~940

PS
回转齿轮箱
Planetary
Slewing
Gearbox



1~1626kW
i=14~947

J/JB
升降机
Jack



0.35~22.63kW
i=5~34

T
转向箱
Spiral Bevel
Gearbox



0.08~303kW
i=1:1~3:1

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