

# EC-TX509-U8(V12)工业以太网通讯卡快速使用指南

本指南简要介绍了 EC-TX509-U8 工业以太网通讯卡的产品信息、安装与接线、调试说明。

扫描二维码，查阅工业以太网通讯卡完整电子说明书。

拨打服务热线 400-700-9997 或访问 www.invt.com.cn 获取更多信息和资源下载。保修条款详见完整版电子说明书。



## 前言

感谢您使用英威腾 EC-TX509-U8 工业以太网通讯卡！

EC-TX509-U8 是一款支持多种协议的工业以太网通讯卡，需与 GD350 等系列产品配合使用，通过多种通讯协议与以太网主站通讯。

本手册提供了产品信息、安装与接线及调试说明。为确保能正确地安装及操作本产品，发挥其优越性能，请在装机之前，详细阅读本手册。

## 产品特点：

- 支持通过功能码选择协议。
- 支持选择多种协议，支持 PROFINET、EtherCAT、EtherNet IP、Modbus TCP、EtherNet UDP、PowerLink、BACnet IP、CC-Link IEFB 等通讯协议。
- 部分协议支持同时运行监控功能，满足现场监控示波需求。
- 具备 2 个 RJ45 端口。
- 通讯速率可达 100Mbit/s，通讯周期短。
- 支持线型和星型网络拓扑，部分协议支持环型网络拓扑。
- 本产品已通过 PROFINET 一致性测试认证。
- 本产品已通过 EtherCAT 一致性测试认证，EtherCAT®是注册商标和专利技术，由德国倍福自动化有限公司授权。EtherCAT 从站地址通过 P16.73 设置。



## 1 产品信息

### 1.1 型号说明

图 1-1 产品铭牌和型号

产品型号	EC-TX-509-U8	
产品类别	EC: 表示扩展卡	
模块类别	TX: 表示通讯卡	区分代码
		509: 表示默认 PROFINET 通讯 U8: 表示支持多种通讯协议

### 1.2 规格参数

表 1-1 规格参数

参数	指标
工作温度	-10~50°C
存储温度	-20~60°C
相对湿度	5%~95%(无凝结)
使用环境	无腐蚀性气体
安装方式	卡槽加螺钉固定
防护等级	IP00
散热方式	自然风冷
通讯速率	100M bit/s
网络拓扑	支持线型和星型网络拓扑，部分协议支持环型网络拓扑

### 1.3 产品结构

图 1-2 产品部件示意图

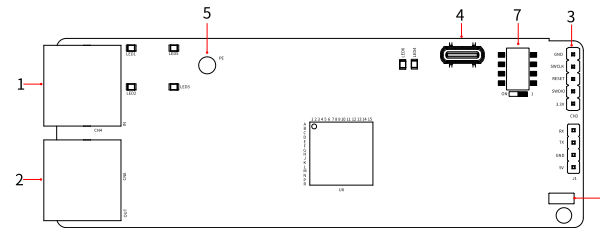


表 1-2 产品部件说明

序号	名称	说明
1	通讯网口	通讯接口 1
2	通讯网口	通讯接口 2
3	调试端口	与调试器之间电气连接
4	烧录配置端口	采用 USB Type-C 与上位机连接
5	安装固定孔位	固定扩展卡，保持 PE 层连接良好
6	定位孔	对齐扩展卡和控制板，便于安装
7	拨码开关	拨码开关切换协议支持部分旧版本控制板软件，优先以功能码 P16.00 切换协议为主，当前协议以 P19.00 显示为准。

## 1.4 指示灯

表 1-3 PROFINET 通讯指示灯

指示灯位号	颜色	定义	功能
LED1 (RUN)	绿	常亮	通讯建立成功，且 IO 数据正常交互
		闪烁(亮 500ms, 灭 500ms)	通讯建立成功，但是无有效的 IO 数据交互
		闪烁(亮 100ms, 灭 100ms)	处于通讯配置阶段，如 DCP 配置指令时触发等，会与 ERR 灯同时闪烁
LED2 (HOST)	绿	常亮	通讯卡正在和变频器握手
		闪烁(亮 500ms, 灭 500ms)	通讯卡和变频器处于正常通讯阶段 <b>注意：</b> 握手完成后的阶段，不管通讯卡和主控板间是否有数据传输，都应闪烁。
		常灭	通讯卡处于初始化或参数配置阶段
LED3 (DATA)	绿	常灭	通讯卡与主控板间无数据更新或更新异常
		闪烁(亮 500ms, 灭 500ms)	通讯卡与主控板间数据更新正常
LED4 (POWER)	红	常亮	3.3V 电源指示灯
LED5 (ERR)	红	常灭	无故障
LED6 (SYS)	绿	闪烁(亮 100ms, 灭 100ms)	通讯建立异常
LED6 (SYS)	绿	闪烁(亮 500ms, 灭 500ms)	通讯卡心跳灯(通讯卡正常运行)

表 1-4 EtherCAT 或 EtherCAT PZD 通讯指示灯

指示灯位号	颜色	定义	功能
LED1 (RUN)	绿	常灭	处于 Init 状态
		闪烁(亮 200ms, 灭 200ms)	处于 PreOP 状态
		单闪(亮 200ms, 灭 1s)	处于 SafeOP 状态
LED2 (L/A IN)	绿	常亮	处于 OP 状态
		闪烁(亮 50ms, 灭 50ms)	接口 IN Link 确立，无数据收发
		常灭	接口 IN LINK 未确立
LED3 (L/A OUT)	绿	常亮	接口 OUT Link 确立，无数据收发
		闪烁(亮 50ms, 灭 50ms)	接口 OUT Link 确立，有数据收发
		常灭	接口 OUT LINK 未确立
LED4 (POWER)	红	常亮	3.3V 电源指示灯
LED5 (ERR)	红	常灭	无故障
		闪烁(亮 200ms, 灭 200ms)	出现 Init/Preop 故障
		单闪(亮 200ms, 灭 1s)	出现 Safeop 故障
LED6 (SYS)	绿	常亮	出现 OP 故障
		闪烁(亮 500ms, 灭 500ms)	通讯卡心跳灯(通讯卡正常运行)

表 1-5 PowerLink 通讯指示灯

指示灯位号	颜色	定义	功能
LED1 (RUN)	绿	常灭	处于 Init 状态
		闪烁(亮 50ms, 灭 50ms)	处于 NMT_CS_BASIC_ETHERNET 状态
		单闪(亮 120ms, 灭 880ms)	处于 NMT_CS_PRE_OPERATIONAL_1 状态
		双闪(亮 100ms, 灭 100ms, 亮 100ms, 灭 700ms)	处于 NMT_CS_PRE_OPERATIONAL_2 状态
		三闪(亮 60ms, 灭 60ms, 亮 60ms, 灭 60ms, 亮 60ms, 灭 700ms, )	处于 NMT_CS_READY_TO_OPERATE 状态
LED2 (HOST)	绿	常亮	处于 NMT_CS_OPERATIONAL 状态
		闪烁(亮 200ms, 灭 200ms)	处于 NMT_CS_STOPPED 状态
		常亮	通讯卡正在和变频器握手
LED3 (DATA)	绿	常亮	通讯卡和变频器处于正常通讯阶段
		闪烁(亮 500ms, 灭 500ms)	<b>注意：</b> 握手完成后的阶段，不管通讯卡和主控板间是否有数据传输，都应闪烁。
		常灭	通讯卡处于初始化或参数配置阶段
LED4 (POWER)	红	常亮	3.3V 电源指示灯
		常灭	无故障
LED5 (ERR)	红	常亮	数据帧丢失、通讯断开、NMT 内部严重错误(非法中断、内存越界等)
		常亮	无故障
LED6 (SYS)	绿	闪烁(亮 500ms, 灭 500ms)	通讯卡心跳灯(通讯卡正常运行)

表 1-6 EtherNet IP 通讯指示灯

指示灯位号	颜色	定义	功能
LED1 (RUN)	绿	常亮	通讯卡和 PLC 通讯在线，且可进行数据交互
		闪烁(亮 500ms, 灭 500ms)	通讯卡和 PLC 的 IP 地址配置异常
		常灭	通讯卡和 PLC 通讯不在“在线”状态
LED2 (HOST)	绿	常亮	通讯卡正在和变频器握手
		闪烁(亮 500ms, 灭 500ms)	通讯卡和变频器处于正常通讯阶段 <b>注意：</b> 握手完成后的阶段，不管通讯卡和主控板间是否有数据传输，都应闪烁。
		常灭	通讯卡处于初始化或参数配置阶段
LED3 (DATA)	绿	常灭	通讯卡与主控板间无数据更新或更新异常
		闪烁(亮 500ms, 灭 500ms)	通讯卡与主控板间数据更新正常
LED4 (POWER)	红	常亮	3.3V 电源指示灯
LED5 (ERR)	红	常灭	无故障
		闪烁(亮 500ms, 灭 500ms)	PLC 配置错误
		闪烁(亮 250ms, 灭 250ms)	通讯卡向 PLC 发送数据失败

指示灯位号	颜色	定义	功能
LED6 (SYS)	绿	闪烁(亮 125ms, 灭 125ms)	通讯卡和 PLC 连接超时
		常亮	通讯卡和 PLC 通讯数据建立失败
		闪烁(亮 500ms, 灭 500ms)	通讯卡心跳灯(通讯卡正常运行)

表 1-7 Modbus TCP 通讯指示灯

指示灯位号	颜色	定义	功能
LED1 (RUN)	绿	常亮	通讯卡和 PLC 通讯在线，且可进行数据交互
		闪烁(亮 500ms, 灭 500ms)	通讯卡和 PLC 的 IP 地址配置异常
		常灭	通讯卡和 PLC 通讯不在“在线”状态
LED2 (HOST)	绿	常亮	通讯卡正在和变频器握手
		闪烁(亮 500ms, 灭 500ms)	通讯卡和变频器处于正常通讯阶段 <b>注意：</b> 握手完成后的阶段，不管通讯卡和主控板间是否有数据传输，都应闪烁。
		常灭	通讯卡处于初始化或参数配置阶段
LED3 (DATA)	绿	常灭	通讯卡与主控板间无数据更新或更新异常
		闪烁(亮 500ms, 灭 500ms)	通讯卡与主控板间数据更新正常
LED4 (POWER)	红	常亮	3.3V 电源指示灯
LED5 (ERR)	红	常亮	通讯卡和 PLC 通讯处于掉线状态
		闪烁(亮 500ms, 灭 500ms)	操作不支持的 CMD 控制字指令或 PR 功能码值
		闪烁(亮 62.5ms, 灭 62.5ms)	操作不存在的节点地址
LED6 (SYS)	绿	常灭	通讯卡与 PLC 通讯正常
		闪烁(亮 500ms, 灭 500ms)	通讯卡心跳灯(通讯卡正常运行)

表 1-8 EtherNet UDP 通讯指示灯

指示灯位号	颜色	定义	功能
LED1 (RUN)	绿	常亮	通讯卡和上位机通讯在线，且可进行数据交互
		闪烁(亮 500ms, 灭 500ms)	通讯卡或 PLC 的 IP 配置异常
		常灭	通讯卡和上位机通讯不在“在线”状态
LED2 (HOST)	绿	常亮	通讯卡正在和变频器握手
		闪烁(亮 500ms, 灭 500ms)	通讯卡和变频器处于正常通讯阶段 <b>注意：</b> 握手完成后的阶段，不管通讯卡和主控板间是否有数据传输，都应闪烁。
		常灭	通讯卡处于初始化或参数配置阶段
LED3 (DATA)	绿	常灭	通讯卡与主控板间无数据更新或更新异常
		闪烁(亮 500ms, 灭 500ms)	通讯卡与主控板间数据更新正常
LED4 (POWER)	红	常亮	3.3V 电源指示灯
LED5 (ERR)	红	常灭	无故障
		闪烁(亮 500ms, 灭 500ms)	Workshop 配置错误(UDP 帧数据异常)
		闪烁(亮 250ms, 灭 250ms)	通讯卡和上位机 Workshop 连接超时
LED6 (SYS)	绿	闪烁(亮 500ms, 灭 500ms)	通讯卡心跳灯(通讯卡正常运行)

表 1-9 BACnet IP 通讯指示灯

指示灯位号	颜色	定义	功能
LED1 (RUN)	绿	常亮	通讯建立成功，且 IO 数据正常交互
		闪烁(亮 500ms, 灭 500ms)	通讯建立成功，但是无有效的 IO 数据交互
		常灭	通讯卡和 PLC 通讯不在“在线”状态
LED2 (HOST)	绿	常亮	通讯卡正在和变频器握手
		闪烁(亮 500ms, 灭 500ms)	通讯卡和变频器处于正常通讯阶段 <b>注意：</b> 握手完成后的阶段，不管通讯卡和主控板间是否有数据传输，都应闪烁。
		常灭	通讯卡处于初始化或参数配置阶段
LED3 (DATA)	绿	常亮	通讯卡与主控板间无数据更新或更新异常
		闪烁(亮 500ms, 灭 500ms)	通讯卡与主控板间数据更新正常
LED4 (POWER)	红	常亮	3.3V 电源指示灯
LED5 (ERR)	红	常灭	无故障
		闪烁(亮 100ms, 灭 100ms)	通讯卡与 PLC 通讯不在“在线”状态
LED6 (SYS)	绿	常亮	通讯卡或 PLC 的 IP 地址配置异常
		闪烁(亮 500ms, 灭 500ms)	通讯卡心跳灯(通讯卡正常运行)

表 1-10 CC-Link IEFB 通讯指示灯

指示灯位号	颜色	定义	功能
LED1 (RUN)	绿	常亮	通讯卡和 PLC 通讯在线，且可进行数据交互
		闪烁(亮 500ms, 灭 500ms)	通讯卡和 PLC 的 IP 地址配置异常
		常灭	通讯卡和 PLC 通讯不在“在线”状态
LED2 (HOST)	绿	常亮	通讯卡正在和变频器握手
		闪烁(亮 500ms, 灭 500ms)	通讯卡和变频器处于正常通讯阶段 <b>注意：</b> 握手完成后的阶段，不管通讯卡和主控板间是否有数据传输，都应闪烁。
		常灭	通讯卡处于初始化或参数配置阶段
LED3 (DATA)	绿	常亮	通讯卡与主控板间无数据更新或更新异常
		闪烁(亮 500ms, 灭 500ms)	通讯卡与主控板间数据更新正常
LED4 (POWER)	红	常亮	3.3V 电源指示灯
LED5 (ERR)	红	常亮	通讯卡和 PLC 通讯数据建立失败
		闪烁(亮 500ms, 灭 500ms)	PLC 配置错误
		闪烁(亮 250ms, 灭 250ms)	通讯卡向 PLC 发送数据失败
LED6 (SYS)	绿	常亮	通讯卡和 PLC 连接超时
		常灭	无故障
LED6 (SYS)	绿	闪烁(亮 500ms, 灭 500ms)	通讯卡心跳灯(通讯卡正常运行)

## 1.5 协议选择

表 1-11 通讯协议选择

功能码	通讯协议	缺省值
P16.00	PROFINET	出厂默认(0)
	EtherCAT	1
	PowerLink	2
	EtherNet IP	3
	Modbus TCP	4
	EtherNet UDP	5
	PROFINET + EtherNet UDP	6
	EtherCAT + EtherNet UDP	7
	Modbus TCP + EtherNet UDP	8
	EtherCAT PZD + EtherNet UDP	9
	BACnet IP	10
CC-Link IEFB	11	
	预留	12~15

表 1-12 拨码开关

序号	通讯协议	拨码说明
0	PROFINET	OFF-OFF-OFF-OFF
1	EtherCAT	OFF-OFF-OFF-ON
2	PowerLink	OFF-ON-ON-OFF
3	EtherNet IP	OFF-OFF-ON-ON
4	Modbus TCP	OFF-ON-OFF-OFF
5	EtherNet UDP	OFF-ON-OFF-ON
6	PROFINET + EtherNet UDP	OFF-ON-ON-OFF
7	EtherCAT + EtherNet UDP	OFF-ON-ON-ON
8	Modbus TCP + EtherNet UDP	ON -OFF-OFF-OFF
9	EtherCAT PZD + EtherNet UDP	ON -OFF-OFF- ON
10	BACnet IP	ON -OFF-ON- OFF
11	CC-Link IEFB	ON -OFF-ON- ON

## 1.6 协议参数

表 1-13 协议参数说明

功能码	通讯协议	说明
P16.00	PROFINET	<ul style="list-style-type: none"> <li>支持 PROFINET 协议，支持 PROFINET IO 设备，支持介质冗余协议 MRP 和系统冗余协议 S2，搭配从站 GSDML 配置文件，可与西门子 PLC 等主站进行通讯。</li> <li>可实现读写变频器过流量、读取变频器状态量和读写变频器功能码等对变频器的基本操作，本通讯卡支持 32 个 IO。</li> <li>支持线型、星型和环型网络拓扑。</li> <li>支持 IRT 模式和 PROFIdrive 行规，支持报文 1、2、3 和 111，PROFINET IO 通过第三方一致性认证。</li> </ul>
	EtherCAT	<ul style="list-style-type: none"> <li>支持 CIA301、CIA402 CoE 协议，搭配从站 XML 配置文件，可与倍福 PLC、英威腾 AX 控制器等主站进行通讯。</li> <li>支持 PDO 服务、SDO 服务、制造商定义的对象字典和 SDO 读写变频器功能码，满足第三方 EtherCAT 一致性测试认证要求。</li> <li>支持线型、星型和环型网络拓扑。</li> <li>具备 2 个 RJ45 端口，区分方向 IN 和 OUT。</li> </ul>
	PowerLink	<ul style="list-style-type: none"> <li>支持 CIA401 协议，搭配从站 XDD 配置文件，可与贝加莱 PLC 等主站进行通讯。</li> <li>支持 PDO 服务、SDO 服务、制造商定义的对象字典和 SDO 读写变频器功能码。</li> <li>支持线型和星型网络拓扑。</li> </ul>
	EtherNet IP	<ul style="list-style-type: none"> <li>支持 ODVA 行规、DLR 环网协议，搭配从站 EDS 配置文件，可与罗克韦尔 PLC 等主站进行通讯。</li> <li>可实现读写变频器过流量、读取变频器状态量、读写变频器功能码等对变频器的基本操作，本通讯卡支持 32 个 IO。</li> <li>支持线型、星型和环型网络拓扑。</li> </ul>
	Modbus TCP	<ul style="list-style-type: none"> <li>支持 Modbus TCP 协议、Modbus TCP 从站和与多个主站同时通讯，可与施耐德 PLC、英威腾 AX 控制器等主站进行通讯。</li> <li>可实现读写变频器过流量、读取变频器状态量、读写变频器功能码等对变频器的基本操作。</li> <li>支持线型和星型网络拓扑。</li> </ul>
	EtherNet UDP	<ul style="list-style-type: none"> <li>支持英威腾 Ethernet 协议、连接英威腾上位机 INVT Workshop，可进行监控和示波，允许多卡组网监控。</li> <li>支持线型和星型网络拓扑。</li> </ul>
	PROFINET+ EtherNet UDP	<ul style="list-style-type: none"> <li>支持同一网络同时运行 PROFINET 和 EtherNet UDP 通讯协议。</li> </ul>
	EtherCAT+ EtherNet UDP	<ul style="list-style-type: none"> <li>支持同一网络同时运行 EtherCAT 和 EtherNet UDP 通讯协议，且 EtherCAT 处于在线状态。</li> </ul>
	Modbus TCP + EtherNet UDP	<ul style="list-style-type: none"> <li>支持同一网络同时运行 Modbus TCP 和 EtherNet UDP 通讯协议。</li> </ul>
	EtherCAT PZD + EtherNet UDP	<ul style="list-style-type: none"> <li>支持 PZD，支持 IN16 字和 OUT16 字，搭配从站 XML 配置文件，可与倍福 PLC、英威腾 AX 控制器、欧姆龙控制器等主站进行通讯。</li> <li>支持读写变频器功能码，满足厂内测试要求。</li> <li>支持线型、星型和环型网络拓扑。</li> <li>具备 2 个 RJ45 端口，区分方向 IN 和 OUT。</li> <li>支持同一网络同时运行 EtherCAT PZD 和 EtherNet UDP 通讯协议，且 EtherCAT 处于在线状态。</li> </ul>
	BACnet IP	<ul style="list-style-type: none"> <li>支持 BACnet IP 协议，支持 BACnet/IP 设备。具备 2 个 BACnet IP 端口支持 10/100M 全/半双工操作，可与 ABB、WAGO PLC 等主站进行通讯。</li> </ul>

功能码	通讯协议	说明
P16.00	PROFINET	<ul style="list-style-type: none"> <li>支持读写单个或多个属性服务、I-Am 服务、I-Have 服务、设备通讯控制服务、重新初始化设备服务。</li> <li>支持 32 个(AV0-AV31)模拟值对象，分别对应控制字、PZD-12 接收字、状态字、PZD-12 发送字、PKW，可对变频器设定给定参数、监测状态值、发送控制命令和监测运行状态以及读写变频器功能码参数。</li> <li>支持线型、星型网络拓扑。</li> </ul>
	CC-Link IEFB	<ul style="list-style-type: none"> <li>支持 CC-Link IEFB 从站协议，支持 IO 设备，搭配 CSPP 配置文件，可与三菱 PLC 主站进行通讯。</li> <li>可实现读写变频器过流量、读取变频器状态量和读写变频器功能码等对变频器的基本操作，本通讯卡支持 32 个 IO。</li> <li>支持线型、星型网络拓扑。</li> </ul>

**注意：**每次更改 P16.00 后，扩展卡将自动复位，并完成协议切换，需经过一段时间后按新协议与 PLC 重新建立连接，期间变频器如果出现对应协议通讯超时故障可按下键复位键清除。

## 2 安装与接线

### 2.1 安装注意事项

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序号	端子说明	功能描述
1	TX+	Transmit Data+ (发信号+)
2	TX-	Transmit Data- (发信号-)
3	RX+	Receive Data+ (收信号+)
4	n/c	Not connected (空脚)
5	n/c	Not connected (空脚)
6	RX-	Receive Data- (收信号-)
7	n/c	Not connected (空脚)
8	n/c	Not connected (空脚)
9	LED1+	LED1+(黄色)
10	LED1-	LED1-(黄色)
11	LED2+	LED2+(绿色)
12	LED2-	LED2-(绿色)

### 2.6 接线注意事项

扩展卡采用标准的 RJ45 接口，其电气接线如图 2-4、图 2-5 和图 2-6 所示。

**注意：**推荐使用双绞屏蔽超五类网线，其水晶头需带铁壳满足接地屏蔽保护。

图 2-4 线型网络拓扑电气连接

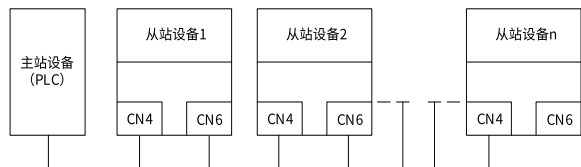
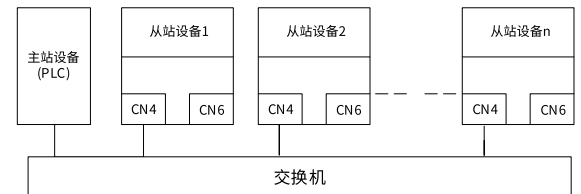
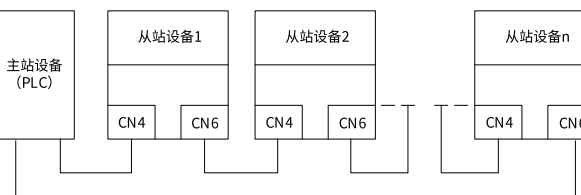


图 2-5 星型网络拓扑电气连接



**注意：**对于星型网络拓扑，用户需准备交换机。

图 2-6 环型网络拓扑电气连接



### 3 调试

图 3-1 扩展卡调试流程

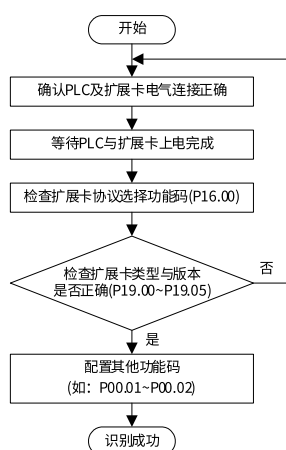


表 3-1 扩展卡相关功能码参数设置

功能码	名称	参数说明	设定范围	缺省值
P16.00	扩展卡协议选择	0: PROFINET 1: EtherCAT 2: PowerLink 3: EtherNet IP 4: Modbus TCP 5: EtherNet UDP 6: PROFINET + EtherNet UDP 7: EtherCAT + EtherNet UDP 8: Modbus TCP + EtherNet UDP 9: EtherCAT PZD + EtherNet UDP 10: BACnet IP 11: CC-Link IEFB	0~15	0

功能码	名称	参数说明	设定范围	缺省值
P16.71	EtherCAT 地址设定源	0: PLC 设定 1: 键盘设定	0~1	0
P16.73	EtherCAT 从站地址	EtherCAT 协议时启用	0x0000~0xFFFF	0x0000
P19.00	卡槽 1 扩展卡类型	36: 多合一扩展卡-PROFINET通讯卡 41: 多合一扩展卡-EtherCAT通讯卡	0~60	0
P19.01	卡槽 2 扩展卡类型	42: 多合一扩展卡-PowerLink通讯卡 43: 多合一扩展卡-EtherNet IP通讯卡 44: 多合一扩展卡-Modbus TCP通讯卡 45: 多合一扩展卡-以太网通讯卡 46: 多合一扩展卡-PROFINET + EtherNet UDP通讯卡 47: 多合一扩展卡-EtherCAT + EtherNet UDP 通讯卡	0~60	0
P19.02	卡槽 3 扩展卡类型	48: 多合一扩展卡-Modbus TCP + EtherNet UDP通讯卡 49: 多合一扩展卡-EtherCAT PZD + EtherNet UDP通讯卡 50: 多合一扩展卡-BACnet IP通讯卡 51: 多合一扩展卡-CC-Link IEFB 通讯卡	0~60	0
P19.03	卡槽 1 扩展卡软件版本		0.00~655.35	0.00
P19.04	卡槽 2 扩展卡软件版本		0.00~655.35	0.00
P19.05	卡槽 3 扩展卡软件版本		0.00~655.35	0.00

P15.43 选择 0(按十进制定义)时，变频器控制字定义如下：

表 3-2 Goodrive350 系列的控制字(CW)“十进制”表示

位(bit)	名称	值	说明
0~7	通讯控制命令	1	正转运行
		2	反转运行
		3	正转点动
		4	反转点动
		5	停机
		6	自由停机
		7	故障复位
		8	点动停止
		9	紧急停机
8	WRITE ENABLE (写使能)	1	写使能(PKW1~PKW4)
9~10	选择电机组别	00	MOTOR GROUP 1 SELECTION(选择电机 1)
		01	MOTOR GROUP 2 SELECTION(选择电机 2)
11	控制模式选择选择	1	转矩控制/速度控制选择使能
		0	不选择
12	ELECTRIC CONSUMPTION CLEAR (用电量清零)	1	用电量清零使能
		0	用电量清零禁止
13	PRE-EXCIATION (预励磁)	1	预励磁使能
		0	预励磁禁止
14	DC BRAKE (直流制动)	1	直流制动使能
		0	直流制动禁止
15	HEARTBEAT REF (心跳给定)	1	心跳使能
		0	心跳禁止

P15.43 选择 1(按二进制定义)时，变频器控制字定义如下：

表 3-3 Goodrive350 系列的控制字(CW)“二进制”表示

位(bit)	名称	说明	优先级
0	正向运行	0: 减速停机 1: 正向运行	1
1	反向运行	0: 减速停机 1: 反向运行	1
2	故障复位	0: 无 1: 故障复位	3
3	自由停机	0: 无 1: 自由停机	4
4	正向点动	0: 无 1: 正向点动	5
5	反向点动	0: 无 1: 反向点动	6
6	点动停止	0: 无 1: 点动停止	7
7	-	保留	-
8	读写使能(PKW1~PKW4)	0: 无 1: 读写使能	-
9	-	保留	-
10	紧急停机	0: 无 1: 紧急停机	0(最优先)
11~15	保留	-	-

P15.43 选择 0(按十进制定义)时，变频器状态字定义如下：

表 3-4 Goodrive350 系列状态字(SW)“十进制”表示

位(bit)	名称	值	说明
0~7	运行状态字节	1	正转运行中
		2	反转运行中
		3	变频器停机中
		4	变频器故障中
		5	变频器 POFF 状态
8	母线电压建立	0	运行准备未就绪
		1	运行准备就绪
9~10	电机组别反馈	0	电机 1 反馈
		1	电机 2 反馈
11	电机类型反馈	0	异步电机
		1	同步电机
12	过载预警反馈	0	未过载预警
		1	过载预警
13~14	RUN/STOP MODE (运行模式选择)	0	键盘控制
		1	端子控制
		2	通讯控制
		3	保留
15	HEARTBEAT FEEDBACK (心跳反馈)	0	无心跳反馈
		1	心跳反馈

P15.43 选择 1(按二进制定义)时，变频器状态字定义如下：

表 3-5 Goodrive350 系列的状态字(SW)“二进制”表示

位(bit)	名称	说明	优先级
0	正向运行	0: 无 1: 正向运行中	1
1	反向运行	0: 无 1: 反向运行中	1
2	停机	0: 无 1: 变频器停机中	3
3	故障	0: 无 1: 变频器故障中	4
4	POFF	0: 无 1: 变频器 POFF 状态	5
5	预励磁	0: 无 1: 变频器预励磁状态	6
6~15	保留	-	-

**注意：**

- 当变频器同时插入 2 张 EC-TX509-U8 扩展卡时，控制板将持续报相同类型扩展卡故障错误(故障代码 55)，取下其中一张卡，故障才能清除。
- 关于扩展卡的其他参数设置，请参考《EC-TX509-U8 工业以太网通讯扩展卡用户手册》。



# EC-TX509-U8(V12) Industrial Ethernet Communication Card Quick Start Guide

This guide briefly introduces the product information, installation and wiring, and commissioning instructions of EC-TX509-U8 industrial Ethernet communication card. Visit [www.invt.com](http://www.invt.com) for more information and source download. For details, see the full version of corresponding product e-manual.



## Preface

Thank you for choosing INVT EC-TX509-U8 industrial Ethernet communication card.

The EC-TX509-U8 is an industrial Ethernet communication card that supports multiple protocols and is designed to be integrated into VFDs like the GD350 series, enabling communication with Ethernet master stations across various protocols.

This guide provides the product overview, installation, wiring, and commissioning instructions. To ensure safe and proper use of the product and to maximize its performance, please carefully read the guide before installation.

### Product features

- Supports protocol selection through function codes.
- Supports multiple protocols, including PROFINET, EtherCAT, EtherNet IP, Modbus TCP, EtherNet UDP, PowerLink, BACnet IP, and CC-Link IEFB.
- Certain protocols support the simultaneous operation of monitoring functions, thereby fulfilling the on-site oscilloscope monitoring requirements.
- Equipped with two RJ45 ports.
- Reaches the communication rate of up to 100 Mbit/s, with a short communication cycle.
- Supports both line and star network topologies, with certain protocols also accommodating ring network topology.
- The product has passed the PROFINET conformance test certification.
- The product has passed the EtherCAT conformance test certification. EtherCAT® is a registered trademark and patented technology, authorized by Beckhoff Automation GmbH, Germany. The EtherCAT slave station address is specified by P16.73.



## 1 Product overview

### 1.1 Model description

Figure 1-1 Product nameplate and model

Product model	EC-TX-509-U8	
Product category	EC: Expansion card	Distinguishing code
Card category	TX: Communication card	509: Default PROFINET communication U8: Support for 8 communication protocols

### 1.2 Specifications

Table 1-1 Specifications

Item	Specifications
Working temperature	-10~50°C
Storage temperature	-20~60°C
Relative humidity	5%~95% (No condensation)
Operating environment	No corrosive gas
Installation method	Secured in the slot with screws
Ingress protection (IP) rating	IP00
Cooling method	Natural air cooling
Communication rate	100M bit/s
Network topology	Supports both line and star network topologies, with certain protocols also accommodating ring network topology.

### 1.3 Product structure

Figure 1-2 Product components

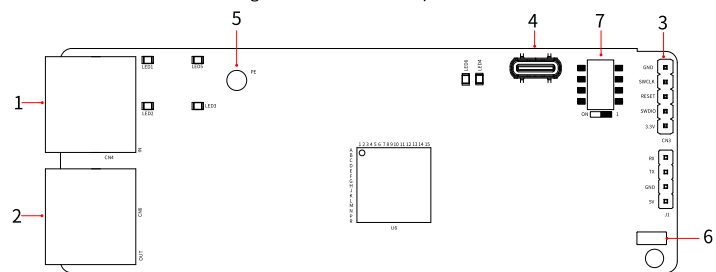


Table 1-2 Component description

No.	Name	Description
1	Communication port	Communication interface 1
2	Communication port	Communication interface 2
3	Debugging port	For electrical connection with the debugger.

No.	Name	Description
4	Programming configuration port	Connects to the host controller through USB Type-C.
5	Installation fixing hole	Helps to secure the expansion card and ensure a good PE layer connection.
6	Positioning hole	Helps to align the expansion card and control board for easy installation.
7	Switch	The DIP switches are only applicable to certain control boards that do not support protocol switching via P16.00. For other control boards, it is recommended to switch the communication protocol via P16.00. See P19.00 for the actual protocol.

## 1.4 Indicator

Table 1-3 PROFINET communication indicators

Indicator	Color	Definition	Function
LED1 (RUN)	Green	Steady on	Communication established successfully, with normal IO data exchange.
		Blinking (on for 500ms, off for 500ms)	Communication established successfully, but without valid IO data exchange.
		Blinking (on for 100ms, off for 100ms)	In the communication configuration phase. For example, when DCP configuration commands are triggered, it will blink simultaneously with the ERR indicator.
LED2 (HOST)	Green	Steady off	The communication between the communication card and PLC is not in Online state.
		Steady on	The communication card is in the process of handshaking with the VFD.
		Blinking (on for 500ms, off for 500ms)	The communication card and VFD communicate normally.
LED3 (DATA)	Green	Steady off	No data update or abnormal update between the communication card and main control board.
		Blinking (on for 500ms, off for 500ms)	The data update between the communication card and main control board is normal.
		Steady on	The communication card is in the process of handshaking with the VFD.
LED4 (POWER)	Red	Steady on	3.3V power indicator
		Steady off	No fault
LED5 (ERR)	Red	Blinking (on for 100ms, off for 100ms)	Communication establishment is abnormal.
		Blinking (on for 500ms, off for 500ms)	Communication card heartbeat indicator (communication card is running normally).

Table 1-4 EtherCAT or EtherCAT PZD communication indicators

Indicator	Color	Definition	Function
LED1 (RUN)	Green	Steady off	In Init state.
		Blinking (on for 200ms, off for 200ms)	In PreOP state.
		Single flash (on for 200ms, off for 1s)	In SafeOP state.
LED2 (L/A IN)	Green	Steady on	In OP state.
		Steady on	IN Link established, without data transmission.
		Blinking (on for 50ms, off for 50ms)	IN Link established, with data transmission.
LED3 (L/A OUT)	Green	Steady off	OUT LINK not established.
		Steady on	OUT Link established, without data transmission.
		Blinking (on for 50ms, off for 50ms)	OUT Link established, with data transmission.
LED4 (POWER)	Red	Steady on	3.3V power indicator
		Steady off	No fault
		Blinking (on for 200ms, off for 200ms)	The Init/Preop fault occurred.
LED5 (ERR)	Red	Single flash (on for 200ms, off for 1s)	The Safeop fault occurred.
		Steady on	The OP fault occurred.
		Blinking (on for 500ms, off for 500ms)	Communication card heartbeat indicator (communication card is running normally).

Table 1-5 PowerLink communication indicators

Indicator	Color	Definition	Function
LED1 (RUN)	Green	Steady off	In Init state.
		Blinking (on for 50ms, off for 50ms)	In NMT_CS_BASIC_ETHERNET state.
		Single flash (on for 120ms, off for 880ms)	In NMT_CS_PRE_OPERATIONAL_1 state.
		Double flashes (on for 100ms, off for 100ms, on for 100ms, off for 700ms)	In NMT_CS_PRE_OPERATIONAL_2 state.

Indicator	Color	Definition	Function
LED2 (HOST)	Green	Triple flashes (on for 60ms, off for 60ms, on for 60ms, off for 700ms)	In NMT_CS_READY_TO_OPERATE state
		Steady on	In NMT_CS_OPERATIONAL state
		Blinking (on for 200ms, off for 200ms)	In NMT_CS_STOPPED state
LED3 (DATA)	Green	Steady on	The communication card is in the process of handshaking with the VFD.
		Blinking (on for 500ms, off for 500ms)	The communication card and VFD communicate normally.
		Steady off	No data update or abnormal update between the communication card and main control board.
LED4 (POWER)	Red	Steady on	3.3V power indicator
		Steady off	No fault
		Blinking (on for 500ms, off for 500ms)	Data frame lost, communication disconnected, or NMT internal critical error (such as illegal interruption and memory overrun).
LED6 (SYS)	Green	Blinking (on for 500ms, off for 500ms)	Communication card heartbeat indicator (communication card is running normally).

Table 1-6 EtherNet IP communication indicators

Indicator	Color	Definition	Function
LED1 (RUN)	Green	Steady on	The communication between the communication card and the PLC is online, and data exchange is allowed.
		Blinking (on for 500ms, off for 500ms)	Abnormal setting of the IP address for either the communication card or the PLC.
		Steady off	The communication between the communication card and host controller is not in Online state.
LED2 (HOST)	Green	Steady on	The communication card is in the process of handshaking with the VFD.
		Blinking (on for 500ms, off for 500ms)	The communication card and VFD communicate normally.
		Steady off	No data update or abnormal update between the communication card and main control board.
LED3 (DATA)	Green	Steady on	The data update between the communication card and main control board is normal.
		Blinking (on for 500ms, off for 500ms)	The communication card and VFD communicate normally.
		Steady off	The communication card is in the process of handshaking with the VFD.
LED4 (POWER)	Red	Steady on	3.3V power indicator
		Steady off	No fault
		Blinking (on for 500ms, off for 500ms)	Incorrect PLC configuration.
LED5 (ERR)	Red	Blinking (on for 250ms, off for 250ms)	The communication card failed to send data to the PLC.
		Blinking (on for 125ms, off for 125ms)	The connection between the communication card and PLC timed out.
		Steady on	Failed to set up data communication between the communication card and PLC.
LED6 (SYS)	Green	Blinking (on for 500ms, off for 500ms)	Communication card heartbeat indicator (communication card is running normally).

Table 1-7 Modbus TCP communication indicators

Indicator	Color	Definition	Function
LED1 (RUN)	Green	Steady on	The communication between the communication card and the PLC is online, and data exchange is allowed.
		Blinking (on for 500ms, off for 500ms)	Abnormal setting of the IP address for either the communication card or the PLC.
		Steady off	The communication between the communication card and PLC is not in Online state.
LED2 (HOST)	Green	Steady on	The communication card is in the process of handshaking with the VFD.
		Blinking (on for 500ms, off for 500ms)	The communication card and VFD communicate normally.

Indicator	Color	Definition	Function
LED3 (DATA)	Green	Steady off	No data update or abnormal update between the communication card and main control board.
		Blinking (on for 500ms, off for 500ms)	The data update between the communication card and main control board is normal.
		Steady on	The communication card is in the process of handshaking with the VFD.
LED4 (POWER)	Red	Steady on	3.3V power indicator
		Steady off	No fault
LED5 (ERR)	Red	Blinking (on for 500ms, off for 500ms)	An attempt to operate an unsupported CMD control word instruction or PR function code value.
		Blinking (on for 62.5ms, off for 62.5ms)	An attempt to operate on a non-existent node address.
		Steady off	The communication between the communication card and PLC is normal.
LED6 (SYS)	Green	Blinking (on for 500ms, off for 500ms)	Communication card heartbeat indicator (communication card is running normally).

Table 1-8 EtherNet UDP communication indicators

Indicator	Color	Definition	Function
LED1 (RUN)	Green	Steady on	The communication between the communication card and host controller is online, and data exchange is allowed.
		Blinking (on for 500ms, off for 500ms)	Abnormal setting of the IP address for either the communication card or the PLC.
		Steady off	The communication between the communication card and host controller is not in Online state.
LED2 (HOST)	Green	Steady on	The communication card is in the process of handshaking with the VFD.
		Blinking (on for 500ms, off for 500ms)	The communication card and VFD communicate normally.
		Steady off	No data update or abnormal update between the communication card and main control board.
LED3 (DATA)	Green	Steady on	The data update between the communication card and main control board is normal.
		Blinking (on for 500ms, off for 500ms)	The communication card and VFD communicate normally.
		Steady off	The communication card is in the process of handshaking with the VFD.
LED4 (POWER)	Red	Steady on	3.3V power indicator
		Steady off	No fault
LED5 (ERR)	Red	Blinking (on for 500ms, off for 500ms)	Workshop configuration error (abnormal UDP frame data).
		Blinking (on for 250ms, off for 250ms)	The connection between the communication card and Workshop on the host controller timed out.
		Steady off	The communication card is in the initialization or parameter configuration phase.
LED6 (SYS)	Green	Steady on	No data update or abnormal update between the communication card and main control board.
		Blinking (on for 500ms, off for 500ms)	The data update between the communication card and main control board is normal.
		Steady off	The communication card is in the initialization or parameter configuration phase.

Table 1-9 BACnet IP communication indicators

Indicator	Color	Definition	Function
LED1 (RUN)	Green	Steady on	Communication established successfully, with normal IO data exchange.
		Blinking (on for 500ms, off for 500ms)	Communication established successfully, but without valid IO data exchange.
		Steady off	The communication between the communication card and PLC is not in Online state.
LED2 (HOST)	Green	Steady on	The communication card is in the process of handshaking with the VFD.
		Blinking (on for 500ms, off for 500ms)	The communication card and VFD communicate normally.
		Steady off	No data update or abnormal update between the communication card and main control board.
LED3 (DATA)	Green	Steady on	The data update between the communication card and main control board is normal.
		Blinking (on for 500ms, off for 500ms)	The data update between the communication card and main control board is normal.

Indicator	Color	Definition	Function
LED4 (POWER)	Red	Steady on	3.3V power indicator
		Steady off	No fault
LED5 (ERR)	Red	Blinking (on for 100ms, off for 100ms)	The communication between the communication card and PLC is not in Online state.
		Blinking (on for 500ms, off for 500ms)	Abnormal setting of the IP address for either the communication card or the PLC.
LED6 (SYS)	Green	Blinking (on for 500ms, off for 500ms)	Communication card heartbeat indicator (communication card is running normally).

Table 1-10 CC-Link IEFB communication indicators

Indicator	Color	Definition	Function
LED1 (RUN)	Green	Steady on	The communication between the communication card and the PLC is online, and data exchange is allowed.
		Blinking (on for 500ms, off for 500ms)	Abnormal setting of the IP address for either the communication card or the PLC.
		Steady off	The communication between the communication card and PLC is not in Online state.
LED2 (HOST)	Green	Steady on	The communication card is in the process of handshaking with the VFD.
		Blinking (on for 500ms, off for 500ms)	The communication card and VFD communicate normally.
		Steady off	No data update or abnormal update between the communication card and main control board.
LED3 (DATA)	Green	Blinking (on for 500ms, off for 500ms)	The data update between the communication card and main control board is normal.
		Steady off	No data update or abnormal update between the communication card and main control board.
LED4 (POWER)	Red	Steady on	3.3V power indicator
LED5 (ERR)	Red	Steady on	Failed to set up data communication between the communication card and PLC.
		Blinking (on for 500ms, off for 500ms)	Incorrect PLC configuration.
		Blinking (on for 250ms, off for 250ms)	The communication card failed to send data to the PLC.
		Blinking (on for 125ms, off for 125ms)	The connection between the communication card and PLC timed out.
LED6 (SYS)	Green	Blinking (on for 500ms, off for 500ms)	Communication card heartbeat indicator (communication card is running normally).

## 1.5 Communication protocol selection

Table 1-11 Communication protocol selection

Function code	Communication protocol	Default
P16.00	PROFINET	Factory setting (0)
	EtherCAT	1
	PowerLink	2
	EtherNet IP	3
	Modbus TCP	4
	EtherNet UDP	5
	PROFINET + EtherNet UDP	6
	EtherCAT + EtherNet UDP	7
	Modbus TCP + EtherNet UDP	8
	EtherCAT PZD + EtherNet UDP	9
	BACnet IP	10
CC-Link IEFB	11	
Reserved	12-15	

Table 1-12 DIP switches

No.	Communication protocol	Switch setting
0	PROFINET	OFF-OFF-OFF-OFF
1	EtherCAT	OFF-OFF-OFF-ON
2	PowerLink	OFF-OFF-ON-OFF
3	EtherNet IP	OFF-OFF-ON-ON
4	Modbus TCP	OFF-ON-OFF-OFF
5	EtherNet UDP	OFF-ON-OFF-ON
6	PROFINET + EtherNet UDP	OFF-ON-ON-OFF
7	EtherCAT + EtherNet UDP	OFF-ON-ON-ON
8	Modbus TCP + EtherNet UDP	ON-OFF-OFF-OFF
9	EtherCAT PZD + EtherNet UDP	ON-OFF-OFF-ON
10	BACnet IP	ON-OFF-ON-OFF
11	CC-Link IEFB	ON-OFF-ON-ON

## 1.6 Protocol parameter

Table 1-13 Protocol parameter description

Function code	Communication protocol	Description
P16.00	PROFINET	• Supports the PROFINET protocol, accommodating PROFINET IO devices, medium redundancy protocol (MRP), and system redundancy protocol (S2). Equipped

Function code	Communication protocol	Description
		with the slave station GSDML configuration file, it can communicate with Siemens PLC and other master stations. <ul style="list-style-type: none"> <li>Enables basic operations on VFDs, such as reading and writing process values, reading status values, and reading/writing function codes. This communication card supports up to 32 IOs.</li> <li>Applicable to line, star, and ring network topologies.</li> <li>Supports IRT mode and PROFIdrive profile, supports telegrams 1, 2, 3, and 111, and PROFINET IO has passed third-party conformance certification.</li> </ul>
	EtherCAT	<ul style="list-style-type: none"> <li>Supports the CiA301 and CiA402 CoE protocols. Configured with a slave station XML configuration file, it can communicate with Beckhoff PLC, INVT AX controllers, and other master stations.</li> <li>Supports PDO and SDO services, manufacturer-defined object dictionaries, and SDO reading/writing of VFD function codes, meeting third-party EtherCAT conformance test certification requirements.</li> <li>Applicable to line, star, and ring network topologies.</li> <li>Equipped with two RJ45 ports, designated for IN and OUT directions.</li> </ul>
	PowerLink	<ul style="list-style-type: none"> <li>Supports the CiA401 protocol. Configured with a slave station XDD configuration file, it can communicate with B&amp;R PLC and other master stations.</li> <li>Supports PDO and SDO services, manufacturer-defined object dictionaries, and SDO reading/writing of VFD function codes.</li> <li>Applicable to line and star network topologies.</li> </ul>
	EtherNet IP	<ul style="list-style-type: none"> <li>Supports ODVA standards and DLR ring protocol. When configured with a slave station EDS configuration file, it can communicate with Rockwell PLC and other master stations.</li> <li>Enables basic operations on VFDs, such as reading and writing process values, reading status values, and reading/writing function codes. This communication card supports up to 32 IOs.</li> <li>Applicable to line, star, and ring network topologies.</li> </ul>
	Modbus TCP	<ul style="list-style-type: none"> <li>Supports the Modbus TCP protocol. A Modbus TCP slave station can communicate with multiple master stations simultaneously. It can communicate with Schneider PLC, INVT AX controllers, and other master stations.</li> <li>Enables basic operations on VFDs, such as reading and writing process values, reading status values, and reading/writing function codes.</li> <li>Applicable to line and star network topologies.</li> </ul>
	EtherNet UDP	<ul style="list-style-type: none"> <li>Supports INVT Ethernet protocol, connecting to the INVT Workshop for monitoring and oscilloscope functionalities, allowing for multi-card network monitoring.</li> <li>Applicable to line and star network topologies.</li> </ul>
	PROFINET+ EtherNet UDP	<ul style="list-style-type: none"> <li>Supports concurrent PROFINET and EtherNet UDP communications on the same network.</li> </ul>
	EtherCAT+ EtherNet UDP	<ul style="list-style-type: none"> <li>Supports concurrent EtherCAT and EtherNet UDP communications on the same network, with EtherCAT required to remain online.</li> </ul>
	Modbus TCP + EtherNet UDP	<ul style="list-style-type: none"> <li>Supports concurrent Modbus TCP and EtherNet UDP communications on the same network.</li> </ul>
	EtherCAT PZD + EtherNet UDP	<ul style="list-style-type: none"> <li>Supports PZD (16-word IN/OUT). Configured with a slave XML configuration file, it can communicate with Beckhoff PLC, INVT AX controllers, Omron controllers, and other master devices.</li> <li>Supports reading and writing of VFD function codes, meeting internal factory testing requirements.</li> <li>Applicable to line, star, and ring network topologies.</li> <li>Equipped with two RJ45 ports, designated for IN and OUT directions.</li> <li>Supports concurrent EtherCAT PZD and EtherNet UDP communications on the same network, with EtherCAT required to remain online.</li> </ul>
	BACnet IP	<ul style="list-style-type: none"> <li>Supports BACnet/IP protocol and BACnet/IP compatible devices. Equipped with two BACnet/IP ports that support 10/100M full/half-duplex operation, enabling communication with master stations such as ABB and WAGO PLCs.</li> <li>Supports Read/Write Property (Single/Multiple), I-Am, I-Have, Device Communication Control, and Reinitialize Device services.</li> <li>Supports 32 analog value objects (AV0-AV31), corresponding to control word, PZD2-12 (Receive), status word, PZD2-12 (Transmit), and PKW, which allow you to set the reference parameters, monitor status values, send control commands and monitor operation status of the VFD, and read and write VFD function parameters.</li> <li>Applicable to line and star network topologies.</li> </ul>
	CC-Link IEFB	<ul style="list-style-type: none"> <li>Supports the CC-Link IEFB slave protocol and IO devices. Configured with the CSPP configuration file, it can communicate with Mitsubishi PLC.</li> <li>Enables basic operations on VFDs, such as reading and writing process values, reading status values, and reading/writing function codes. This communication card supports up to 32 IOs.</li> <li>Applicable to line and star network topologies.</li> </ul>

**Note:** After each change of P16.00, the expansion card will automatically reset and complete the protocol switchover. It will take some time to re-establish communication with the PLC using the new protocol. If a communication timeout fault occurs on the VFD during this period, you can clear it by pressing the reset key on the keypad.

## 2 Installation and wiring

### 2.1 Installation precautions

Ensure the VFD is powered off before installation.

**Note:** According to the expansion card installation slot position specifications, for VFDs with three card slots, it is recommended to install the expansion card in SOLT3; for VFDs with only two slots, it is recommended to install the expansion card in SOLT2.

Tools required for installation: Phillips screwdriver PH1; flat screwdriver SL3.

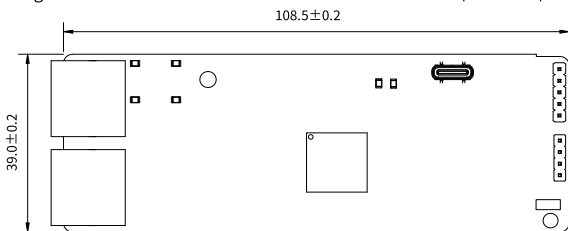
Table 2-1 Screw torque requirements

Screw size	Fastening torque
M3	0.55N·m

### 2.2 Dimensions

The dimensions are 108.5×39mm, as shown in the following figure.

Figure 2-1 Product outline and installation dimensions (unit: mm)



### 2.3 Installation instructions

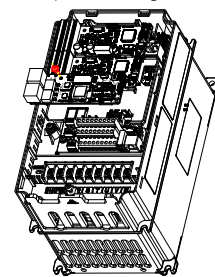
The following shows an example of the installation in slot 3 (see Figure 2-2).

Step 1 Position the expansion card in the designated area of slot 3 on the control board, ensuring proper alignment with the slot before securely fastening it together.

Step 2 Guide the expansion card into place using the positioning stud.

Step 3 Secure it in position with M3 screws, completing the installation.

Figure 2-2 Installation position diagram (VFD with three slots)



#### **Note:**

- The expansion card and control board are electrically connected through slots. Please install them in place.
- To ensure the reliable operation of the expansion card and EMC requirements are met, please tighten the screws according to the recommended torque for reliable grounding.

### 2.4 Removal instructions

The removal procedure is the reverse of the installation procedure described in section 2.3 Installation instructions.

Step 1 Disconnect the power supply and remove all cables connected to the expansion card.

Step 2 Use a Phillips screwdriver to remove the grounding screw of the expansion card.

Step 3 Pull the expansion card out to a suitable position.

### 2.5 User's wiring terminals

Figure 2-3 RJ45 terminal structure



Table 2-2 RJ45 terminal function definition

No.	Description	Function description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected
9	LED1+	LED1+ (Yellow)
10	LED1-	LED1- (Yellow)
11	LED2+	LED2+ (Green)
12	LED2-	LED2- (Green)

### 2.6 Wiring precautions

The communication card uses standard RJ45 interfaces, and its electrical connections are shown in Figure 2-4 Figure 2-5 and Figure 2-6.

**Note:** It is recommended to use double-twisted shielded Category 5e Ethernet cables, with crystal heads equipped with iron shells to meet the grounding shield protection.

Figure 2-4 Line network topology electrical connection

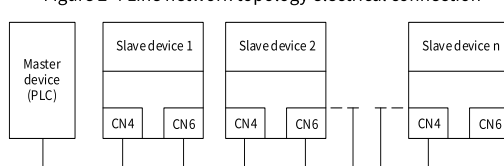
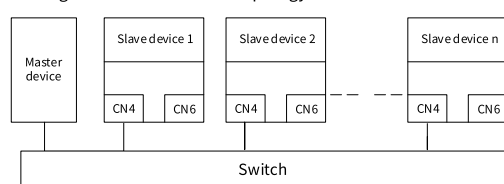
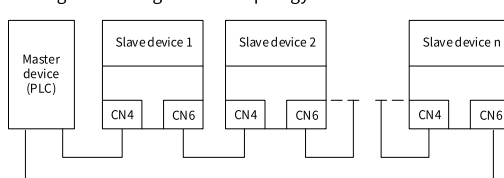


Figure 2-5 Star network topology electrical connection



#### **Note:** For the star network topology, you need to prepare switches.

Figure 2-6 Ring network topology electrical connection



## 3 Commissioning

Figure 3-1 Expansion card commissioning flowchart

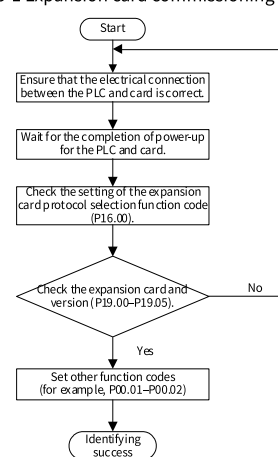


Table 3-1 Function parameters related to the expansion card

Function code	Name	Parameter description	Setting range	Default
P16.00	Expansion card protocol selection	0: PROFINET 1: EtherCAT 2: PowerLink 3: EtherNet IP 4: Modbus TCP 5: EtherNet UDP 6: PROFINET + EtherNet UDP 7: EtherCAT + EtherNet UDP 8: Modbus TCP + EtherNet UDP 9: EtherCAT PZD + EtherNet UDP 10: BACnet IP 11: CC-Link IEFB	0-15	0
P16.71	EtherCAT address setting source	0: PLC 1: Keypad	0-1	0
P16.73	EtherCAT slave station address	Effective only when the EtherCAT protocol is enabled.	0x0000-0xFFFF	0x0000
P19.00	Slot 1 expansion card type	36: All-in-one expansion card—PROFINET communication card 41: All-in-one expansion card—EtherCAT communication card	0-60	0
P19.01	Slot 2 expansion card type	42: All-in-one expansion card—PowerLink communication card 43: All-in-one expansion card—EtherNet IP communication card 44: All-in-one expansion card—Modbus TCP communication card 45: All-in-one expansion card—Ethernet communication card	0-60	0
P19.02	Slot 3 expansion card type	46: All-in-one expansion card—PROFINET + EtherNet UDP communication card 47: All-in-one expansion card—EtherCAT + Ethernet UDP communication card 48: All-in-one expansion card—Modbus TCP + EtherNet UDP communication card 49: All-in-one expansion card—EtherCAT PZD + EtherNet UDP communication card 50: All-in-one expansion card—BACnet IP	0-60	0

Function code	Name	Parameter description	Setting range	Default
		communication card 51: All-in-one expansion card—CC-Link IEFB communication card		
P19.03	Slot 1 expansion card software version		0.00-655.35	0.00
P19.04	Slot 2 expansion card software version		0.00-655.35	0.00
P19.05	Slot 3 expansion card software version		0.00-655.35	0.00

When P15.43 is 0 (defined in decimal), the VFD control word (CW) definitions are as follows:

Table 3-2 Goodrive350 series VFD CWs in decimal

Bit	Name	Value	Description
0-7	Communication-based control command	1	FWD run
		2	REV run
		3	FWD jog
		4	REV jog
		5	Stop
		6	Coast to stop
		7	Fault reset
		8	Jog stop
		9	Emergency stop
8	WRITE ENABLE	1	Enable read and write (PKW1-PKW4)
9-10	Motor group setting	00	MOTOR GROUP 1 SELECTION
		01	MOTOR GROUP 2 SELECTION
11	Control mode selection	1	Torque/Speed control selection enabling
		0	Do not select
12	ELECTRIC CONSUMPTION CLEAR	1	Enable the function for resetting power consumption to zero
		0	Disable the function for resetting power consumption to zero
13	PRE-EXCITATION	1	Enable pre-excitation
		0	Disable pre-excitation
14	DC BRAKE	1	Enable DC braking
		0	Disable DC braking
15	HEARTBEAT REF	1	Enable heartbeat
		0	Disable heartbeat

When P15.43 is 1 (defined in binary), the VFD control CW definitions are as follows:

Table 3-3 Goodrive350 series VFD CWs in binary

Bit	Name	Description	Priority
0	FWD run	0: Decelerate to stop 1: Run forward	1
1	REV run	0: Decelerate to stop 1: Run reversely	1
2	Fault reset	0: None 1: Fault reset	3
3	Coast to stop	0: None 1: Coast to stop	4
4	Forward jogging	0: None 1: Forward jogging	5
5	Reverse jogging	0: None 1: Reverse jogging	6
6	Jog stop	0: None 1: Jog stop	7
7	-	Reserved	-
8	Enable read and write (PKW1-PKW4)	0: None 1: Enable read and write	-
9	-	Reserved	-
10	Emergency stop	0: None 1: Emergency stop	0 (Top priority)
11-15	Reserved	-	-

When P15.43 is 0 (defined in decimal), the VFD status word (SW) definitions are as follows:

Table 3-4 Goodrive350 series VFD SWs in decimal

Bit	Name	Value	Description
0-7	Run status byte	1	Running forward
		2	Running reversely
		3	VFD in stopped state
		4	VFD in fault
		5	VFD in POFF state
8	Bus voltage established	0	Not ready to run
		1	Ready to run
9-10	Motor group feedback	0	Feedback from motor 1
		1	Feedback from motor 2
11	Motor type feedback	0	Asynchronous motor (AM)
		1	Synchronous motor (SM)
12	Overload pre-alarm feedback	0	No overload pre-alarm
		1	Overload pre-alarm

Bit	Name	Value	Description
13-14	RUN/STOP MODE	0	Keypad-based control
		1	Terminal-based control
		2	Communication-based control
15	HEARTBEAT FEEDBACK	3	Reserved
		0	No heartbeat feedback
		1	Heartbeat feedback

When P15.43 is 1 (defined in binary), the VFD SW definitions are as follows:

Table 3-5 Goodrive350 series VFD SWs in binary

Bit	Name	Description	Priority
0	FWD run	0: None 1: Running forward	1
1	REV run	0: None 1: Running reversely	1
2	Stop	0: None 1: VFD in stopped state	3
3	Fault	0: None 1: VFD in fault	4
4	POFF	0: None 1: VFD in POFF state	5
5	Pre-excitation	0: None 1: VFD in pre-exciting state	6
6-15	Reserved	-	-

#### **Note:**

- When two EC-TX509-U8 cards are inserted into a VFD at the same time, the control board will continuously report a fault indicating the same card type (fault code 55). Removing one of the cards will clear the fault.
- For other parameter settings of the expansion card, see the *EC-TX509-U8 Industrial Ethernet Communication Card User Manual*.



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