EC-PG 系列 PG 扩展模块说明书

前 言

感谢您使用英威腾 EC-PG 系列 PG 扩展模块!

EC-PG 系列 PG 扩展模块用于检测不同类型的编码器传输的信息，可以选配电梯产品 EC160 系列一体机以及 GD300L、GD390L 变频器整机等。扩展模块通过检测编码器的输出信号来监测电机的旋转速度，为精确速度控制提供实时速度反馈。

本说明书提供了产品信息、安装、接线与调试说明。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，详细阅读本说明书。

产品特点

- 针对不同类型编码器进行多路信号检测
- 为编码器提供电源：5V±5%或 12V±5%或 24V±5%/300mA（具体见各 PG 卡详细说明）
- 支持多种信号类型输入（具体见各 PG 卡详细说明）
- 支持脉冲给定与分频输出
- 具有编码器断线检测功能，避免系统故障影响扩大
- 采用数字滤波技术，提高电磁兼容性，实现编码器信号长距离稳定接收

1 产品信息

1.1 产品型号定义

EC - PG 1 01 - 05 - V R2

① ② ③ ④ ⑤ ⑥ ⑦

表 1-1 型号说明

标识	标识说明	命名举例
①	产品类别	EC：扩展卡
②	板卡类别	PG：PG 卡
③	技术版本	用 1、3、5 四数来表示技术版本的第 1、第 2、第 3 代
④	区分代码	01：增量式编码器 PG 卡 02：正余弦编码器 PG 卡 03：UVW 编码器 PG 卡 04：旋转变压器 PG 卡 05：增量型编码器 PG 接口+脉冲方向给定 06：绝对值编码器 PG 卡接口
⑤	工作电源	00：无源 05：5V 12：12-15V 24：24V
⑥	安装方式	缺省：90°弯插插针 V：180°直插插针
⑦	版本号	R2：扩展卡版本

1.2 产品规格

表 1-2 规格说明

PG 卡类型	型号	功能规格
增量 PG 卡	EC-PG101-05 R2	5V 增量 PG 卡 90°插针 5V 推挽、开路集电极、差分输出增量型编码器
	EC-PG101-12 R2	12V 增量 PG 卡 90°插针 12V 推挽、开路集电极、差分输出增量型编码器
	EC-PG101-12-V	12V 增量 PG 卡 180°插针 12V 推挽、开路集电极、差分输出增量型编码器
	EC-PG101-24 R2	24V 增量 PG 卡 90°插针 24V 推挽、开路集电极、差分输出增量型编码器
正余弦 PG 卡	EC-PG102-05	Sin/Cos 型编码器
UVW 型 PG 卡	EC-PG103-05	5V 标准的 UVW 编码器
绝对值 PG 卡	EC-PG106-05-V	5V 绝对值 PG 卡 180°插针 5V 绝对值编码器
	EC-PG106-05 R2	5V 绝对值 PG 卡 90°插针 5V 绝对值编码器

2 增量式编码器 PG 卡

2.1 型号说明与技术指标

表 2-1 技术指标

规格型号	EC-PG101-05	EC-PG101-12	EC-PG101-24
输出电源	可调电压范围：4.75~7V 出厂设定：5V±5% 最大输出 300mA 电流	支持 11.75~16V 电压输出， 出厂值 12V±5%，最大输出 350mA 电流	24V±5%电压输出，最大输出 300mA 电流
输入信号	支持差动、集电极开路、推挽编码器 A、B、Z 信号输入，响应速度 0~100kHz	支持差动、集电极开路、推挽编码器 A、B、Z 信号输入，响应速度 0~100kHz	支持差动、集电极开路、推挽编码器 A、B、Z 信号输入，响应速度 0~100kHz
输出信号	输出频率：0~80kHz 输出形式：差分输出、推挽输出、集电极开路输出、分频输出 范围：1~256 输出阻抗：70Ω	输出频率：0~80kHz 输出形式：差分输出、推挽输出、集电极开路输出、分频输出 范围：1~256 输出阻抗：70Ω	输出频率：0~80kHz 输出形式：差分输出、推挽输出、集电极开路输出、分频输出 范围：1~256 输出阻抗：70Ω

2.2 增量式编码器 PG 卡安装和尺寸图

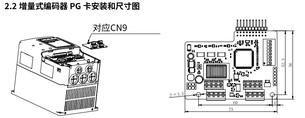


图 2-1 增量式编码器 PG 卡安装图

图 2-2 增量式编码器 PG 卡尺寸图

2.3 增量式编码器 PG 卡使用说明

2.3.1 功能

当用户使用 PG 矢量控制时，必须选用 PG 卡。PG 卡的功能包括两路正交编码器信号的处理电路并支持主轴定位 Z 信号输入，可以接收差动型、集电极开路型和推挽型输出的编码器信号，可以对输入的编码器信号进行分频输出，输出量为包含两路差动信号，可选过跳线 J1、J2 选择输出信号为集电极开路信号，请用户根据自己的实际使用情况进行选择。

2.3.2 端子及跳码说明

增量式编码器 PG 卡有 2 个 2*4P 用户接线端子，如图。

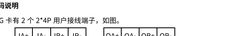


图 2-3 增量式编码器 PG 卡用户接线端子

其中，PWR、COM1 为编码器工作电源输出；IA+、IA-、IB+、IB-、IZ+、IZ-为编码器信号输入端子；OA+、OA-、OB+、OB-为 5V 差动分频信号输出端子，OA、OB、COM1 为分频推挽信号与集电极开路信号输出端子（通过跳线 J1、J2 选取输出信号形式）；

增量式编码器 PG 卡的分频系数由卡上的拨码开关来决定，拨码开关共有 8 位，根据其表示的 2 进制数加 1 来确定分频系数，拨码开关上标为 "1" 的为二进制低位，标为 "8" 的为二进制高位。当拨码拨向 ON 时，该位为有效，表示 "1"，相反则为 "0"。分频系数见下表：

表 2-2 分频系数

十进制数	二进制数	分频系数
0	00000000	1
1	00000001	2
2	00000010	3
…	…	…
m	…	m+1
255	11111111	256

2.3.3 接线原理示意图

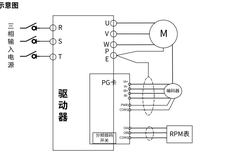


图 2-4 增量式编码器 PG 卡接线原理示意图

2.3.4 接线注意事项

1. PG 卡信号线要与动力线分开，禁止平行走线；

2. 为避免编码器信号受到干扰，请选用屏蔽电缆作为 PG 卡信号线；
3. 编码器屏蔽电缆的屏蔽层应该接大地（如变频器 PE 端），并且一定是单端接大地，以免信号受到干扰；
4. PG 卡为频输出如果外接用户电源，则电压应小于 24V，否则将损坏 PG 卡；
5. 用户可根据实际需求通过调整 12~15V 增量式编码器 PG 卡电位器（顺时针电压增大），设定输出电压，旋转电位器时，用力不宜过大。

2.4 应用连接

2.4.1 输入应用连接

1. 差动输出编码器连接示意图

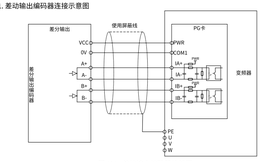


图 2-5 差动输出编码器接线图

2. 开路集电极输出编码器连接示意图

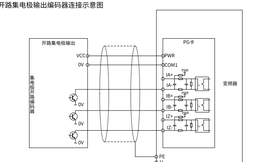


图 2-6 集电极开路输出编码器接线图

3. 推挽式输出编码器连接示意图

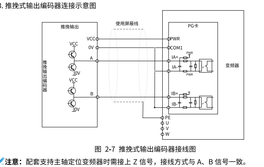


图 2-7 推挽式输出编码器接线图

注意： 配套支持主轴定位变频器时需接上 Z 信号，接线方式与 A、B 信号一致。

2.4.2 输出应用连接

1. PG 卡分频差分输出连接示意图

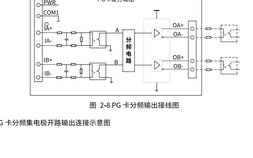


图 2-8 PG 卡分频输出接线图

2. PG 卡分频集电极开路输出连接示意图

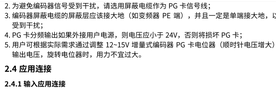


图 2-9 PG 卡分频集电极开路输出接线图

注意： 开路集电极输出时 J1、J2 处 PWR 分别与 COA、COB 短接。

3. PG 卡分频推挽输出连接示意图

图 2-10 PG 卡分频推挽输出接线图

注意：

- 推挽输出时 J1、J2 处 PWR 分别与 HOA、HOB 短接。
- 增量型编码器 PG 卡主要应用于异步电动机闭环矢量控制。

3 正余弦编码器 PG 卡与 UVW 型编码器 PG 卡

3.1 型号说明与技术指标

正余弦编码器 PG 卡与 UVW 编码器 PG 卡，其规格说明见表 3-1。

表 3-1 技术参数表

规格型号	EC-PG102-05	EC-PG103-05
分频系数	1（没有分频给码开关）	1~256（有分频给码开关）
输出电源	可调电压范围：4.75~7V 出厂设定：5V±5% 最大输出电流：300mA	可调电压范围：4.75~7V 出厂设定：5V±5% 最大输出电流：300mA
输出信号	输出形式：两路正交分频差分输出，开路集电极输出 集电极开路输出阻抗：70Ω	输出形式：两路正交差分输出，开路集电极输出 集电极开路输出阻抗：70Ω

用户可根据自己的实际应用来选择输出电压大小，在编码器信号远距离传输时，用户可通过电位器调节输出电源电压（调压方式与增量式编码器卡一致），以增加接线距离。

3.2 正余弦编码器 PG 卡安装和尺寸图

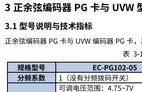


图 3-1 正余弦编码器 PG 卡安装图

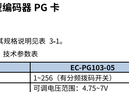


图 3-2 正余弦编码器 PG 卡尺寸图

3.3 UVW 编码器 PG 卡安装和尺寸图

图 3-3 UVW 编码器 PG 卡安装图

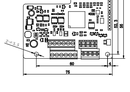


图 3-4 UVW 编码器 PG 卡尺寸图

注意：

- UVW 编码器 PG 卡与增量式编码器 PG 卡安装方法和位置一样，其对应为双排 2x10 插针。
- 正余弦编码器 PG 卡尺寸及安装方式与 UVW 编码器 PG 卡一样，只是没有分频用的拨码开关，DB15 母头改为端子式接线，电位器位置为 R101。

3.4 端子接口及拨码说明

正余弦编码器 PG 卡共有 1 个信号线端子和 1 个用户接线端子，见图 3-5。

A+	A-	B+	B-	C+	C-	
GND		PWR	R	B-	D+	D-

PG 卡接线口

OA+	OA-	OB+	OB-
OA	OB	COM1	

分频输出接口

图 3-5 正余弦 PG 卡接线口和接线端子

UVW 编码器 PG 卡与正余弦编码器 PG 卡一样，共有 1 个编码器信号接口和 1 个分频输出接口，见图 3-6。

DB15

OA+	OA-	OB+	OB-
OA	OB	COM1	

分频输出接口

图 3-6 UVW 编码器 PG 卡接线口和接线端子

OA+、OA-、OB+、OB-为差分输出信号端子（LVDS 差分电平），OA、OB、COM1 为集电极开路信号输出端子。

注意：

- PG 卡内部没有将 PE 接大地，用户使用时可自行接大地。
- 正余弦编码器 PG 卡、UVW 编码器 PG 卡，输出信号接线方式与增量式编码器 PG 卡一致，但不支持推挽输出。

DB15 三排母头接口为编码器的信号输入接口，PG 卡接口信号排列顺序对照表 3-2。

表 3-2 DB15 接口信号排列顺序对照表

PG 卡接口	UVW
5	A+
6	A-
8	B+
1	B-
3	Z+
4	Z-
11	U+
10	U-
12	V+
13	V-
9	PWR
7	GND
14	W
15	W-
2	空

当应用 UVW PG 卡时，只需把 UVW 编码器的信号排列与 UVW 编码器 PG 卡信号排列相对应的 DB15 公头插入 PG 卡 DB15 母头中即可。

UVW 型编码器 PG 卡的分频系数设定与增量型编码器一样，分频系数见表 2-2。

注意： UVW 编码器 PG 卡，可支持 5V 增量型编码器差分信号处理，输入接线方式与增量型编码器 PG 卡一致，主要应用到接线端口为 DB15 上的 A、B、Z、PWR 与 GND 端口。

4 绝对值编码器 PG 卡

4.1 型号说明与技术指标

绝对值编码器 PG 卡（主要适用 ECN1313，ECN413 编码器等），其规格说明见表 4-1。

表 4-1 技术参数表

规格型号	EC-PG106-05
分频系数	1~4（通过插拔排针 J2 的短路帽实现）
输入信号	支持两路差动 A、B（正弦信号，1Vpp）输入，响应速度 0~50kHz；支持 EnDat2.1 协议传送绝对位置值信号，故障等信息
输出电源	可调电压范围：4.75~7V 出厂设定：5V±5% 最大输出电流：300mA
输出信号	输出形式：两路正交分频差分输出（LVCMOS 电平），开路集电极输出 集电极开路输出阻抗：70Ω

4.2 绝对值编码器 PG 卡安装和尺寸图

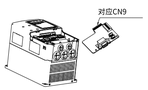


图 4-1 绝对值编码器 PG 卡安装图

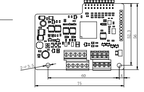


图 4-2 绝对值编码器 PG 卡尺寸图

注意： 绝对值编码器 PG 卡安装方法和位置和 UVW 编码器 PG 卡一样，其对应为双排 2×10 插针。

4.3 端子接口

4.3.1 端子接口说明

绝对值编码器 PG 卡共有 1 个编码器接口和 1 个分频输出接口，见图 4-3。

A+	A-	B+	B-	PWR	
DATA+	DATA-	CLK+	CLK-	GND	

PG 卡接线口

OA+	OA-	OB+	OB-	
OA	OB	COM1	PE	

分频输出接口

图 4-3 PG 卡接线口和接线端子

OA+、OA-、OB+、OB-为差分输出（LVCMOS）信号端子，OA、OB、COM1 为集电极开路信号输出端子。

注意：

- PG 卡端子 PE 请连接编码器线屏蔽层；
- PG 卡 H2 安装孔与驱动底层 UVW 处 PE 端子连接。

绝对值编码器 PG 卡的分频系数通过插拔排针 J2 的短路帽实现，J2 为 1*4PIN 排针，共有 2 位，根据其表示的 2 进制数加 1 来确定分频系数，绝对值 PG 卡出厂时 J2 端子处自带两个短接帽拨码 SET 信号拉低，默认不分频，当短路帽插上时，对应 SET 信号接地，表示 "0"，相反接掉短路帽，对应 SET 信号电平拉高，为 "1"，分频系数见下表：

表 4-2 分频系数

SET1	SET2	十进制数	二进制数	分频系数
0	0	0	00	1
0	1	1	01	2
1	0	2	10	3
1	1	3	11	4

4.3.2 接线原理示意图

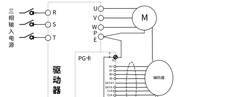


图 4-4 绝对值编码器 PG 卡接线原理示意图

4.3.3 接线注意事项

1. PG 卡信号线要与动力线分开，禁止平行走线；
2. 为避免编码器信号受到干扰，请选用屏蔽电缆作为 PG 卡信号线；
3. 编码器屏蔽电缆的屏蔽层应该接大地（如变频器 PE 端），并且一定是单端接大地，以免信号受到干扰；
4. PG 卡为频输出如果外接用户电源，则电压应小于 24V，否则将损坏 PG 卡；
5. 用户可根据实际需求通过调整绝对值编码器 PG 卡电位器（顺时针电压增大），设定输出电压，旋转电位器时，用力不宜过大。

5 调试说明

5.1 相关功能码（以 GD300L 为例）

为了便于功能码的设定，在使用键盘进行操作时，功能组号对应一级菜单，功能码号对应二级菜单，功能码参数对应三级菜单。

功能表的各列内容说明如下：

第 1 列 "功能码"：为功能参数组及参数的编号；

第 2 列 "名称"：为功能参数的完整名称；

第 3 列 "参数详细说明"：为该功能参数的详细描述；当进行恢复缺省参数操作时，功能码参数被刷新后显示出厂值，但实际设定的参数值或记录值，则不会被刷新；

第 4 列 "缺省值"：为功能参数的出厂原始设定值；

第 5 列 "更改"：为功能参数的更改属性（即是否允许更改和更改条件），说明如下：

"○"：表示该参数的设定值在变频器处于停机、运行状态中，均可更改；

"◎"：表示该参数的设定值在变频器处于运行状态时，不可更改；

"●"：表示该参数的数值是实际检测记录值，不能更改。

功能码	名称	参数详细说明	缺省值	更改
P00.00	速度控制模式	0：无 PG 矢量控制 1：有 PG 矢量控制 2：V/F 控制 3：闭环矢量控制	2	◎
P00.01	运行指令通道	0：键盘指令通道（LED 熄灭） 1：端子指令通道（LED 闪烁） 2：通讯指令通道（LED 点亮） 3：CAN 指令通道（LED 点亮）	1	◎
P00.02	电梯额定速度	0.100~4.000m/s	1.500m/s	◎
P00.03	速度指令选择	0：键盘设定 1：模拟量 AI1 设定 2：模拟量 AI2 设定 3：多段速运行设定 4：远程通讯设定 5：模拟量 AI1 跟踪运行 6：CAN 通讯给定 7：CAN 给定跟随运行	3	◎
P00.04	最大输出频率	10.00~600.00Hz	50.00Hz	◎
P00.05	键盘设定速度	0m/s~P00.02（电梯额定速度）	1.500m/s	○
P00.09	电机参数自学习	0：无操作 1：异步机空载旋转参数自学习 2：异步机静止参数自学习 3：同步机带载旋转自学习 4：同步机静止自学习 5：同步机带载旋转自学习	0	◎
P00.10	功能参数恢复	0：无操作 1：恢复缺省值 2：清除故障档案 3：回滚功能参数：读取功能参数，由 P07.01 的最低位设置为 5 保存。	0	◎

P02 组 电机参数组				
P02.00	电机类型选择	0：异步机 1：同步机	0	◎
P02.01	电机额定功率	0.1~3000.0kW	机型确定	◎
P02.02	电机额定频率	0.01Hz~P00.04（最大频率）	50.00Hz	◎
P02.03	电机额定转速	1~36000rpm	机型确定	◎
P02.04	电机额定电压	0~1200V	机型确定	◎
P02.05	电机额定电流	0.8~6000.0A	机型确定	◎
P02.14	曳引轮直径	100~2000mm	500mm	◎
P02.15	减速比	0.50~50.00	1.00	◎

P03 组 矢量控制组				
P03.00	速度环比例增益 1	0~200	20	○
P03.01	速度环积分时间 1	0.000~10.000s	0.200s	○
P03.02	切换低点频率	0.00Hz~P03.05	5.00Hz	○
P03.03	速度环比例增益 2	0~200	20	○
P03.04	速度环积分时间 2	0.000~10.000s	0.200s	○
P03.05	切换高点频率	P03.02~P00.04（最大输出频率）	10.00Hz	○
P03.06	速度环输出滤波	0~8（对应 0~2^8*125μs）	0	○
P03.09	电流环比例系数 P	**注意：** 该两个参数调节的是电流环的 PI 调节参数，它直接影响系统的动态响应速度和控制精度，一般情况下用户无需更改该缺省值。设定范围：0~20000	1000	○
P03.10	电流环积分系数 I		1000	○

P20 组 编码器参数组				
P20.00	编码器类型选择	0：增量型编码器(AB) 1：ABZUVW 编码器 2：旋变编码器 3：Sin/Cos 编码器不带 CD 信号 4：Sin/Cos 编码器带 CD 信号 5：EnDat	0	◎
P20.01	编码器脉冲数	编码器旋转一圈所发出的脉冲数。设定范围：0~60000	1024	◎
P20.02	编码器方向	个位：AB 方向 0：正向 1：反向 十位：保留 百位：CD/UVW 磁极信号方向 0：正向 1：反向	0x000	◎
P20.03	编码器断线故障检测时间	编码器断线故障的检测时间。设定范围：0.0~10.0s	1.0s	○
P20.04	编码器反向故障检测时间	编码器反向故障的检测时间。设定范围：0.0~100.0s	0.8s	○
P20.05	编码器检测滤波次数	设定范围：0x000~0x999 个 位 ： 低 速 滤 波 次 数 ； 对 应 2^(0-9)*125μs。 十 位 ： 高 速 滤 波 次 数 ； 对 应 2^(0-9)*125μs。 百 位 ： 细 分 测 速 滤 波 ； 对 应 2^(0-9)*125μs。	0x133	○
P20.09	Z 脉冲初始角	编码器 Z 脉冲与电机磁极位置的相对电角度。设定范围：0.00~359.99	0	○
P20.10	磁极初始角	编码器位置与电机磁极位置的相对电角度。设定范围：0.00~359.99	0	○

5.2 调试举例

1. 异步机闭环矢量调试步骤

（1）设置 P00.10=1，恢复出厂参数设置

（2）设置 P00.00=3，P00.03=3 及 P02 组电机铭牌参数

（3）验证编码器安装及设置是否正确

可按螺旋转电机或手动螺旋拉电机，观测 P17.21（当编码器为旋变时）值应该是 0~359.9 递增或递减均匀变化，这表明编码器接线正确。

2. 同步机闭环矢量控制调试步骤

（1）设置 P00.10=1，恢复出厂参数设置

（2）设置 P00.00=3（闭环矢量控制），设置 P00.03=3，P00.04，及 P02 组电机铭牌参数

（3）设置 P00.09、P20.01 编码器参数

当编码器为旋变编码器时，请设定编码器脉冲数为（旋变极对数*1024），如 4 对极旋变，应设置 P20.01=4096。

（4）验证编码器安装及设置是否正确

可按螺旋转电机，观测 P17.21（当编码器为旋变时）值应该是 0~359.9 递增或递减均匀变化，这表明编码器接线正确。

（5）磁极初始位置自学习

设置 P00.09=3 或 4（3 为旋转自学习，4 为静止自学习），按 RUN 键运行变频器。

a）旋转自学习

自学习开始时检测当前磁极位置，然后加速到 XXHz(与设定速度有关)，然后减速停机。

自学习过程中，如报 ENC10 故障，编码器断线或编码器线序反，请重复（4），如无问题，设置 P20.02=1（与初始偏极反），重新自学习。

b）静止自学习

自学习过程只检测当前磁极位置，电机不旋转，学习得到的磁极位置保存在 P20.10 中。

选择静止自学习时，建议多学几次。

（6）闭环矢量试运行

如果出现电流震荡（噪音），适当调整电流环 P03.09，P03.10 的值（不同编码器与电机类型要调成合适 PI 参数，建议可以先调小，然后从小往大逐步调整到电流震荡和噪音消失），如果速度震荡，适当调整速度环 P03.00 及 P03.03 的值（建议可以先调小，由小往大逐步调整到速度稳定为止）。在低速如果有电流振荡声，可调整速度环输出滤波参数 P03.06。

注意： 更改电机线或编码器线后需要重新确定编码器的方向 P20.02，同时需要重新进行磁极位置自学习。

202605 (V1.2)

66001-01516

EC-PG Series PG Expansion Module User Manual

Preface

Thank you for choosing INVT EC-PG series PG expansion module.

The EC-PG series PG expansion module is used to detect information transmitted by different types of encoders and is compatible with elevator products such as the EC160 series integrated controller, as well as GD300L, GD390L variable frequency drives(VFDs). The expansion module monitors the rotational speed of the motor by detecting the output signal of the encoder, providing real-time speed feedback for precise speed control.

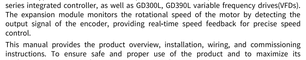
This manual provides the product overview, installation, wiring, and commissioning instructions. To ensure safe and proper use of the product and to maximize its performance, please carefully read the manual before installation.

Product features

- Multi-channel signal detection for different types of encoders
- Provides power supply for encoders: 5V±5%, 12V±5%, or 24V±5%/300mA (see detailed specifications for each PG card)
- Supports multiple input signal types (see detailed specifications for each PG card)
- Supports pulse input and frequency division output
- Features detection of encoder disconnection to prevent system fault escalation
- Utilizes digital filtering technology to enhance electromagnetic compatibility and achieve stable long-distance reception of encoder signals

1 Product overview

1.1 Model definition



EC - PG 1 01 - 05 - V R2

① ② ③ ④ ⑤ ⑥ ⑦

Table 1-1 Model description

Symbol	Field	Example
①	Product category	EC: Expansion card
②	Board card category	PG: PG card
③	Technology version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, and 5 indicate the 1st, 2nd, and 3rd versions of the technical version.
④	Code	01: Incremental encoder PG card 02: Sin/Cos encoder PG card 03: UVW encoder PG card 04: Resolver PG card 05: Incremental encoder PG interface + pulse direction reference 06: Absolute encoder PG card interface
⑤	Working power supply	00: No power (passive) 05: 5V 12: 12~15V 24: 24V
⑥	Installation method	Default: 90° right-angle pin header V: 180° straight pin header
⑦	Version	Expansion card version

1.2 Product specifications

Table 1-2 Specification description

PG card type	Model	Specification
Incremental PG card	EC-PG101-05 R2	5V incremental PG card with 90° pin header 5V push-pull, open collector, and differential output incremental encoder
	EC-PG101-12 R2	12V incremental PG card with 90° pin header 12V push-pull, open collector, and differential output incremental encoder
	EC-PG101-12-V	12V incremental PG card with 180° pin header 12V push-pull, open collector, and differential output incremental encoder
	EC-PG101-24 R2	24V incremental PG card with 90° pin header 24V push-pull, open collector, and differential output incremental encoder
Sin/Cos PG card	EC-PG102-05	Sin/Cos encoder
UVW-type PG card	EC-PG103-05	5V-powered UVW encoder
Absolute PG card	EC-PG106-05-V	5V absolute PG card with 180° pin header 5V absolute encoder
	EC-PG106-05 R2	5V absolute PG card with 90° pin header 5V absolute encoder

2 Incremental encoder PG card

2.1 Model description and technical parameters

Table 2-1 Technical parameters

Model	EC-PG101-05	EC-PG101-12	EC-PG101-24
Output power supply	Adjustable voltage range: 4.75~7V Default setting: 5V±5% Max. output current: 300mA	Supporting the voltage output of 11.75~16V. Default: 12V±5%. Max. output current: 350mA	Voltage output: 24 V±5% Max. output current: 300mA
Input signal	Supporting the A, B, and Z signal inputs of differential, open collector, and push-pull encoders. Response speed: 0~100kHz	Supporting the A, B, and Z signal inputs of differential, open collector, and push-pull encoders. Response speed: 0~100kHz	Supporting the A, B, and Z signal inputs of differential, open collector, and push-pull encoders. Response speed: 0~100kHz
Output signal	Output frequency: 0~80kHz Output mode: Differential output, push-pull output, open collector output, and frequency-divided output Range: 1~256 Output impedance: 70Ω	Output frequency: 0~80kHz Output mode: Differential output, push-pull output, open collector output, and frequency-divided output Range: 1~256 Output impedance: 70Ω	Output frequency: 0~80kHz Output mode: Differential output, push-pull output, open collector output, and frequency-divided output Range: 1~256 Output impedance: 70Ω

2.2 Installation and dimensions

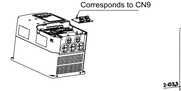


Figure 2-1 Incremental encoder PG card installation diagram

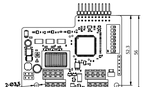


Figure 2-2 Incremental encoder PG card dimension drawing

2.3 Incremental encoder PG card use instructions

2.3.1 Function

A PG card is a must for PG vector control. The PG card functions include processing circuits for two quadrature encoder signals and supporting spindle positioning Z signal inputs, and receiving signals of differential, open collector and push-pull encoder. Frequency-divided output can be performed for the input encoder signals. The output quantity includes two channels of differential signals. You can choose to output push-pull signals or open collector signals through jumper J1 or J2 according to your actual use.

2.3.2 Terminal and switch description

The incremental encoder PG card has two 2*4P user wiring terminals. See Figure 2-3.

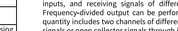


Figure 2-3 Wiring terminals of incremental encoder PG card

PWR and COM1 are for encoder working power output; IA+, IA-, IB+, IB-, IZ+, and IZ- are encoder signal input terminals; OA+, OA-, OB+, OB- are 5V differential frequency-division signal output terminals, while OA, OB, and COM1 are frequency-divided push-pull signal and open collector signal output terminals (the output signal type is selected by jumper J1 or J2).

The frequency division coefficient of the incremental encoder PG card is determined by the switch on the card. The switch has 8 bits, and the frequency division coefficient is determined by adding 1 to the binary number that the switch represents. The place labeled with "1" is the low binary bit, and the one labeled with "8" is the high binary bit. When the switch is turned to ON, the bit is valid, indicating "1"; otherwise, the bit indicates "0". See the following table for frequency division coefficients.

Table 2-2 Frequency division coefficient

Decimal	Binary	Frequency division coefficient
0	00000000	1
1	00000001	2
2	00000010	3
…	…	…
m	…	m+1
255	11111111	256

2.3.3 Wiring principles

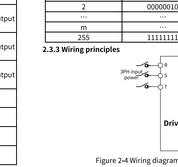


Figure 2-4 Wiring diagram of incremental encoder PG card

2.3.4 Wiring precautions

1. A PG card signal line and a power line must be routed separately and disallow parallel routing.
2. To avoid interference from encoder signals, use a shielded cable for the PG card signal line.
3. The shield layer of the encoder shield cable should be connected to the earth (such as the PE of VFD), and it must be connected to earth only at one end to avoid signal interference.
4. If the PG card uses frequency-divided output when connecting to an external power supply, the voltage should be less than 24V; otherwise the PG card will be damaged.
5. You can set the output voltage by adjusting the 12~15V incremental encoder PG card potentiometer (clockwise for voltage increases) according to actual needs, and the force should not be too great when rotating the potentiometer.

2.4 Application connection

2.4.1 Input application connection

① Differential output encoder connection

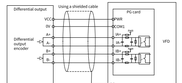


Figure 2-5 Wiring diagram of differential output encoder

② Open collector output encoder connection

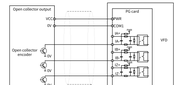


Figure 2-6 Wiring diagram of open collector output encoder

③ Push-pull output encoder connection

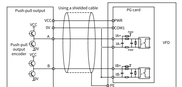


Figure 2-7 Wiring diagram of push-pull output encoder

Note: When the spindle positioning VFD is supported, the Z signal needs to be connected, of which the wiring method is similar to that for the A and B signals.

2.4.2 Output application connection

① PG card frequency-divided differential output connection

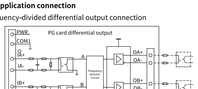


Figure 2-8 Wiring diagram of PG card frequency-divided output

② PG card frequency-divided open collector output connection

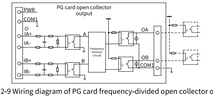


Figure 2-9 Wiring diagram of PG card frequency-divided open collector output

Note: During open collector output, PWR at J1 and that at J2 are short connected to COA and COB.

③ PG card frequency-divided push-pull output connection

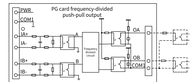


Figure 2-10 Wiring diagram of PG card frequency-divided push-pull output

Note:

- During push-pull output, PWR at J1 and that at J2 are short connected to HOA and HOB.
- Incremental encoder PG cards are mainly used to closed-loop vector control on asynchronous motors.

3 Sin/Cos encoder and UVW encoder PG card

3.1 Model description and technical parameters

See Table 3-1 for the specifications of Sin/Cos encoder and UVW encoder PG cards.

Table 3-1 Technical parameters

Model	EC-PG102-05	EC-PG103-05
Frequency division coefficient	1 (Without a frequency-division switch)	1~256 (With frequency-division switch)
Output power supply	Adjustable voltage range: 4.75~7V Default setting: 5V±5% Max. output current: 300mA	Adjustable voltage range: 4.75~7V Default setting: 5V±5% Max. output current: 300mA
Output signal	Output form: Two quadrature frequency division differential outputs, and one open collector output Open collector output impedance: 70Ω	Output form: Two quadrature differential outputs, and one open collector output Open collector output impedance: 70Ω

You can choose the output voltage value according to the actual application. When the encoder signal is transmitted at a long distance, you can adjust the output power supply voltage by potentiometer (the regulation method is the same as incremental encoder card) to increase the wiring distance.

3.2 Installation and dimensions of Sin/Cos encoder PG card

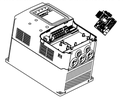


Figure 3-1 Sin/Cos encoder PG card installation diagram

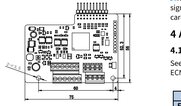


Figure 3-2 Sin/Cos encoder PG card dimension drawing

3.3 Installation and dimensions of UVW encoder PG card

Installation diagram of SM PG card

Figure 3-3 UVW encoder PG card installation diagram

Figure 3-4 UVW encoder PG card dimension drawing

Note:

- The UVW encoder PG card is installed in the same way and position as the incremental encoder PG card. It corresponds to a double row of 2 x 10 pins.
- The Sin/Cos encoder PG card has the same size and mounting method as the UVW encoder PG card, except that it does not have a switch for frequency division, the DB15 female connector is replaced with terminal wiring, and the potentiometer position is R101.

3.4 Terminal interfaces and switch description

The Sin/Cos encoder PG card has one signal line terminal and one user terminal, as shown in Figure 3-5.

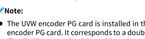


Figure 3-5 Wiring interface and terminals of the Sin/Cos PG card

Same as the Sin/Cos encoder PG card, the UVW encoder PG card has one encoder signal interface and one frequency-divided output interface, as shown in the Figure 3-6.

DB15 Frequency-divided output interface

Figure 3-6 Ports and terminals of PG card

OA+, OA-, OB+, and OB- are differential output signal terminals (LVDS differential level), while OA, OB, and COM1 are open collector signal output terminals.

Note:

- The PG card does not internally connect the PE to the earth, and you can connect the PE to the earth during use.
- The Sin/Cos encoder PG card and UVW encoder PG card have the similar output signal wiring method as the incremental encoder PG card, but they do not support push-pull output.

The DB15 three-row female interface is the encoder signal input interface. Table 3-2 shows the PG card interface signal arrangement sequence.

Table 3-2 DB15 interface signal arrangement sequence

PG card interface	Sin/Cos	UVW
5	A+	A+
6	A-	A-
8	B+	B+
1	B-	B-
3	R+	Z+
4	R-	Z-
11	C+	U+
10	C-	U-
12	D+	V+
13	D-	V-
9	PWR	PWR
7	GND	GND
14	Empty	W
15	Empty	W-
2	Empty	Empty

When applying either of the UVW PG card, you only need to insert the DB15 male connector of the UVW encoder into the DB15 female connector of the PG card.

Setting the frequency division coefficient of a UVW encoder PG card is similar to that for an incremental encoder PG card. For details about frequency division coefficients, see Table 2-2.

Note: UVW encoder PG cards can support 5V incremental encoders with differential signal processing, have the similar wiring method with that for incremental encoder PG cards, and mainly use wiring ports include the A, B, Z, PWR, and GND ports on DB15.

4 Absolute encoder PG card

4.1 Model description and technical parameters

See Table 4-1 for the specifications of absolute encoder PG card (mainly applicable to ECN1313, ECN413 encoders).

Table 4-1 Technical parameters

Model	EC-PG106-05
Frequency division coefficient	1~4 (set via jumper cap on pin header J2)
Input signal	Supports two differential A and B (sine signal, 1Vpp) inputs with the response speed of 0~50kHz; Supports the transmission of absolute position value signal, fault and other information in EnDat2.1 protocol.
Output power supply	Adjustable voltage range: 4.75~7V Default setting: 5V±5% Max. output current: 300mA
Output signal	Output form: Two quadrature frequency division differential outputs (LVCMOS electrical level), and one open collector output Open collector output impedance: 70Ω

4.2 Installation and dimensions

Installation diagram of SM PG card

Figure 4-1 Absolute encoder PG card installation diagram

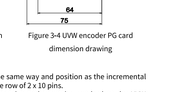


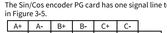
Figure 4-2 Outline dimensions of absolute encoder PG card

Note: The absolute encoder PG card is installed in the same way and position as the UVW encoder PG card. It corresponds to a double row of 2 x 10 pins.

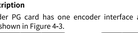
4.3 Terminal interfaces

4.3.1 Interface description

The absolute encoder PG card has one encoder interface and one frequency-divided output interface, as shown in Figure 4-3.



PG card wiring interface



Frequency-divided output interface

Figure 4-3 Ports and terminals of PG card

OA+, OA-, OB+, and OB- are differential output (LVCMOS) signal terminals, while OA, OB, and COM1 are open collector signal output terminals.

Note:

- Connect the PG card terminal PE to the encoder cable shield layer.
- The H2 mounting hole of the PG card should be connected to the PE terminal at the UVW base of the drive.

The frequency division coefficient of the absolute encoder PG card is set by plugging or unplugging the jumper caps on the J2 pin header. J2 is a 1×4PIN header with two positions, and the frequency division coefficient is determined by the binary value represented by the jumper positions plus one. The absolute PG card comes with two jumper caps on the J2 terminal that pull the SET signals low by default (no frequency division). When a jumper cap is plugged in, the corresponding SET signal is grounded, representing "0"; when the jumper is removed, the SET signal is pulled high, representing "1". The frequency division coefficient is shown in the following table:

Table 4-2 Frequency division coefficient

SET1	SET2	Decimal	Binary	Frequency division coefficient
0	0	0	00	1
0	1	1	01	2
1	0	2	10	3
1	1	3	11	4

4.3.2 Wiring principles

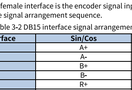


Figure 4-4 Wiring diagram of absolute encoder PG card

4.3.3 Wiring precautions

1. A PG card signal line and a power line must be routed separately and disallow parallel routing.
2. To avoid interference from encoder signals, use a shielded cable for the PG card signal line.
3. The shield layer of the encoder shield cable should be connected to the earth (such as the PE of VFD), and it must be connected to earth only at one end to avoid signal interference.
4. If the PG card uses frequency-divided output when connecting to an external power supply, the voltage should be less than 24V; otherwise the PG card will be damaged.
5. You can set the output voltage by adjusting the absolute encoder PG card potentiometer (clockwise for voltage increases) according to actual needs, and the force should not be too great when rotating the potentiometer.

5 Commissioning

5.1 Function codes related (taking GD300L as an example)

The function group numbers correspond to the level-1 menus, the function codes correspond to the level-2 menus, and the function parameters correspond to the level-3 menus.

The function code table contains:

Column 1 "Function code": Code of the function group and parameter.

Column 2 "Name": Full name of the function parameter.

Column 3 "Description": Factory setting of the function parameter. If the value of the parameter is detected or recorded, the value cannot be restored to the factory setting.

Column 4 "Default": Initial value set in factory.

Column 5 "Modify": Whether the function parameter can be modified, and conditions for the modification.

"○" indicates that the value of the parameter can be modified when the VFD is in stopped or running state.

"◎" indicates that the value of the parameter cannot be modified when the VFD is in running state.

"●" indicates that the value of the parameter is detected and recorded, and cannot be modified.

Function code	Name	Description	Default	Modify
Group P00	Basic functions			
P00.00	Speed control mode	0: Sensorless vector control (SVC) 1: Feedback vector control (FVC) 2: V/F control 3: Closed-loop vector control	2	◎
P00.01	Channel of running commands	0: Keypad (the indicator is off) 1: Terminal (the indicator blinks) 2: Communication (the indicator is on) 3: CAN (the indicator is on)	1	◎
P00.02	Rated speed of the lift	0.100~4.000m/s	1.500m/s	◎

Function code	Name	Description	Default	Modify
P00.03	Speed command selection	0: Keypad 1: AI1 2: AI2 3: Multi-step speed running 4: Remote communication 5: AI1 tracking running 6: CAN communication-based setting 7: CAN communication-based reference	3	◎
P00.04	Max. output frequency	10.00~600.00Hz	50.00Hz	◎
P00.05	Speed set through keypad	0m/s~P00.02 (rated lift speed)	1.500m/s	○
P00.09	Motor parameter autotuning	0: No operation 1: Rotating parameter autotuning on empty-load asynchronous motor 2: Static parameter autotuning on asynchronous motor 3: Rotating parameter autotuning on empty-load synchronous motor 4: Static parameter autotuning on synchronous motor 5: Rotating parameter autotuning on synchronous motor with load	0	◎
P00.10	Function parameter restoration	0: No operation 1: Restore default values 2: Clear fault records 3. Roll back function parameters, reading function parameters that are saved when the LSB of P07.01 is set to 5.	0	◎
Group P02	Motor parameters			
P02.00	Motor type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0	◎
P02.01	Motor rated power	0.1~3000.0kW	Model depended	◎
P02.02	Motor rated frequency	0.01Hz~P00.04 (max. output frequency)	50.00Hz	◎
P02.03	Motor rated speed	1~36000rpm	Model depended	◎
P02.04	Motor rated voltage	0~1200V	Model depended	◎
P02.05	Motor rated current	0.8~6000.0A	Model depended	◎
P02.14	Pulley diameter	100~2000mm	500mm	◎
P02.15	DEC ratio	0.50~50.00	1.00	◎
Group P03	Vector control			
P03.00	Speed-loop proportional gain 1	0~200	20	○
P03.01	Speed-loop integral time 1	0.000~10.000s	0.200s	○
P03.02	Low-point frequency for switching	0.00Hz~P03.05	5.00Hz	○
P03.03	Speed-loop proportional gain 2	0~200	20	○
P03.04	Speed-loop integral time 2	0.000~10.000s	0.200s	○
P03.05	High-point frequency for switching	P03.02~P00.04 (Max. output frequency)	10.00Hz	○
P03.06	Speed-loop output filter	0~8 (corresponding to 0~2^8*125μs)	0	○
P03.09	Current-loop proportional coefficient P	**Note:** The two function parameters impact the dynamic response speed and control accuracy of the system. Generally, you do not need to modify the two function parameters.	1000	○
P03.10	Current-loop integral coefficient I	Setting range: 0~20000	1000	○
Group P20	Encoder parameters			
P20.00	Encoder type selection	0: Incremental encoder (AB) 1: ABZUVW encoder 2: Resolver-type encoder 3: Sin/Cos encoder without CD signals 4: Sin/Cos encoder with CD signals 5: EnDat	0	◎
P20.01	Encoder pulse count	Number of pulses generated when the encoder revolves for one circle. Setting range: 0~60000	1024	◎
P20.02	Encoder direction	Ones place: AB direction 0: Forward 1: Reverse	0x000	◎

Function code	Name	Description	Default	Modify
P20.03	Encoder disconnection fault detection time	Tens place: Reserved Hundreds place: CD/UVW pole signal direction 0: Forward 1: Reverse Indicates the detection time of encoder offline fault. Setting range: 0.0~10.0s	1.0s	○
P20.04	Encoder reversal fault detection time	Indicates the detection time of encoder reversal fault. Setting range: 0.0~10.0s	0.8s	○
P20.05	Filter times of encoder detection	Setting range: 0x000~0x999 Ones place: Low-speed filter time, corresponding to 2^(0~9)×125μs. Tens place: High-speed filter times, corresponding to 2^(0~9)×125μs. Hundreds place: Subdivision speed filter times, corresponding to 2^(0~9)×125μs.	0x133	○
P20.09	Initial angle of Z pulse	Relative electric angle between the encoder Z pulse and the motor pole position. Setting range: 0.00~359.99	0	○
P20.10	Pole initial angle	Relative electric angle between the encoder position and the motor pole position. Setting range: 0.00~359.99	0	○

5.2 Examples

1. Commissioning procedure for closed-loop vector control on AMs

(1) Set P00.10=1 to restore to default settings.

(2) Set P00.00=3, P00.03=3 and motor nameplate parameters in group P02.

(3) Verify whether the encoder is installed and set properly.

Slowly rotate the motor or manually oscillate the motor. If the encoder is a resolver, the value of P17.21 should increase or decrease uniformly within the range of 0 to 359.9, indicating correct encoder wiring.

2. Commissioning procedure for closed-loop vector control on SMs

(1) Set P00.10=1 to restore to default settings.

(2) Set P00.00=3 (closed-loop vector control), set P00.03=3, P00.04, and motor nameplate parameters in group P02.

(3) Set the encoder parameters P20.00 and P20.01.

When the encoder is a resolver-type encoder, set the encoder pulse count value to (resolver pole pair count x 1024). For example, if the pole pair count is 4, set P20.01 to 4096.

(4) Verify whether the encoder is installed and set properly.

Slowly rotate the motor. If the encoder is a resolver, the value of P17.21 should increase or decrease uniformly within the range of 0 to 359.9, indicating correct encoder wiring.

(5) Autotune the initial position of magnetic pole.

Set P00.09 to 3 (rotary autotuning) or 4 (static autotuning), and press the RUN key to run the VFD.

a) Rotary autotuning (P00.09=3)

Detect the present magnetic pole position when autotuning starts, and then accelerate to XX Hz (depending on the set speed), and then decelerate to stop.

During autotuning process, if an ENC1O fault occurs, indicating an encoder disconnection or reversed encoder wiring, repeat step (4). If no issues are found, set P20.02 = 1 (opposite to the initial value) and restart autotuning.

b) Static autotuning

The autotuning process only detects the present pole position without rotating the motor. The magnetic pole position obtained from autotuning is saved to P20.10 automatically.

When using static autotuning, it is recommended to perform the process multiple times.

(6) Perform closed-loop vector pilot-run.

If current oscillation (noise) occurs, properly adjust the current loop parameters P03.09 and P03.10 (different encoder and motor types require appropriate PI parameters. It is recommended to start with smaller values and gradually increase them until the current oscillation and noise disappear). If speed oscillation occurs, properly adjust the speed loop parameters P03.00 and P03.03. Similarly, start with smaller values and increase gradually until the speed becomes stable. If current oscillation noise occurs during low speed running, adjust P03.06.

Note: You must re-determine P20.02 (encoder direction) and perform magnetic pole position autotuning again if the motor or encoder wires are swapped.

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