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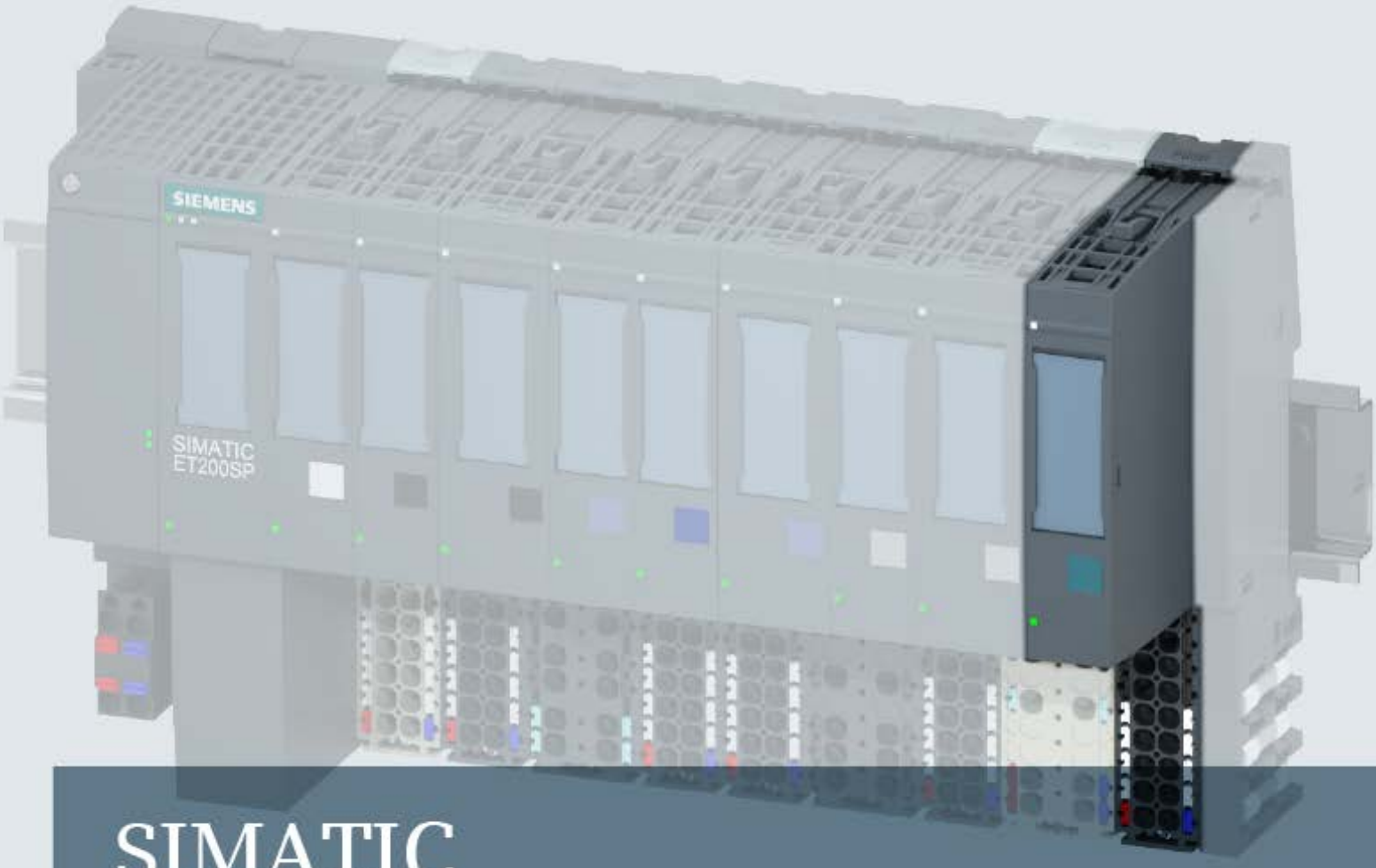

SIMATIC

ET 200SP

TM PosInput 1 工艺模块 (6ES7138-6BA00-0BA0)

版本 04/2016

SIEMENS

SIMATIC

ET 200SP
工艺模块 TM PosInput 1
(6ES7138-6BA00-0BA0)

设备手册

04/2016

A5E33015759-AC

法律资讯

警告提示系统

为了您的人身安全以及避免财产损失，必须注意本手册中的提示。人身安全的提示用一个警告三角表示，仅与财产损失有关的提示不带警告三角。警告提示根据危险等级由高到低如下表示。

⚠危险
表示如果不采取相应的小心措施，**将会**导致死亡或者严重的人身伤害。

⚠警告
表示如果不采取相应的小心措施，**可能**导致死亡或者严重的人身伤害。

⚠小心
表示如果不采取相应的小心措施，可能导致轻微的人身伤害。

注意
表示如果不采取相应的小心措施，可能导致财产损失。

当出现多个危险等级的情况下，每次总是使用最高等级的警告提示。如果在某个警告提示中带有警告可能导致人身伤害的警告三角，则可能在该警告提示中另外还附带有可能导致财产损失的警告。

合格的专业人员

本文件所属的产品/系统只允许由符合各项工作要求的**合格人员**进行操作。其操作必须遵照各自附带的文件说明，特别是其中的安全及警告提示。 由于具备相关培训及经验，合格人员可以察觉本产品/系统的风险，并避免可能的危险。

按规定使用 Siemens 产品

请注意下列说明：

⚠警告
Siemens 产品只允许用于目录和相关技术文件中规定的使用情况。如果要使用其他公司的产品和组件，必须得到 Siemens 推荐和允许。正确的运输、储存、组装、装配、安装、调试、操作和维护是产品安全、正常运行的前提。必须保证允许的环境条件。必须注意相关文件中的提示。

商标

所有带有标记符号 ® 的都是西门子股份有限公司的注册商标。本印刷品中的其他符号可能是一些其他商标。若第三方出于自身目的使用这些商标，将侵害其所有者的权利。

责任免除

我们已对印刷品中所述内容与硬件和软件的一致性作过检查。然而不排除存在偏差的可能性，因此我们不保证印刷品中所述内容与硬件和软件完全一致。印刷品中的数据都按规定经过检测，必要的修正值包含在下一版本中。

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前言

本文档用途

本手册包含有关具体工艺模块的接线、诊断和技术规范信息。

有关设计和调试 ET 200SP 的常规信息，请参见 ET 200SP 系统手册。

工艺模块 TM PosInput 1 的计数和测量功能及定位输入在“计数、测量和定位输入 (http://support.automation.siemens.com/WW/view/zh/59709820)”功能手册中进行了详细说明。

约定

请遵循下面所标注的注意事项：

说明

注意事项包含有关本文档所述的产品、使用该产品或应特别关注的文档部分的重要信息。

安全信息

西门子为其产品及解决方案提供工业安全功能，以支持工厂、解决方案、机器、设备和/或网络的安全运行。 这些功能是整个工业安全机制的重要组成部分。 有鉴于此，西门子不断对产品和解决方案进行开发和完善。 西门子强烈建议您定期检查产品的更新和升级信息。

要确保西门子产品和解决方案的安全操作，还须采取适当的预防措施（例如：设备单元保护机制），并将每个组件纳入全面且先进的工业安全保护机制中。 此外，还需考虑到可能使用的所有第三方产品。更多有关工业安全的信息，请访问 Internet (http://www.siemens.com/industrialsecurity)。

要及时了解有关产品的更新和升级信息，请订阅相关产品的实事信息。 更多相关信息，请访问 Internet (http://support.automation.siemens.com)。

开源软件

在所述产品的固件中采用了开源软件 (Open Source Software)。 “开源软件”免费提供。 我们根据适用于产品的规定对所述产品及包含在内的开源软件负责。 Siemens 不对开源软件的非预期用途或因修改开源软件引起的任何故障承担任何责任。

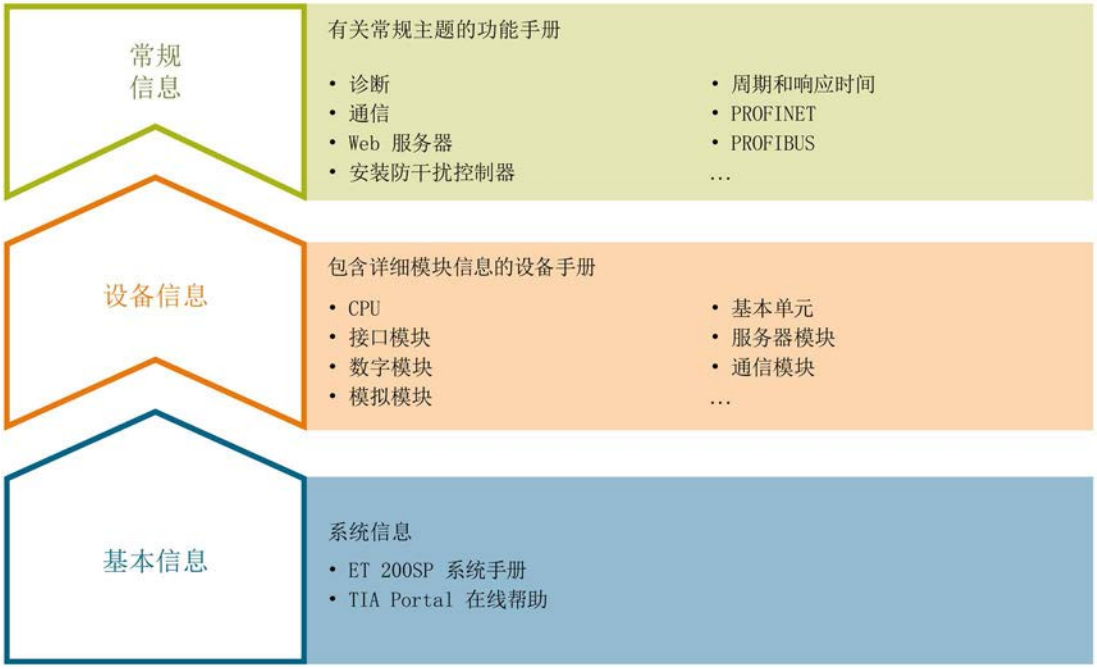
出于法律上的原因，我们有责任原文公布许可条件和版权提示。 相关信息请参见附录。

目录

文档指南

1

SIMATIC SIMATIC ET 200SP 分布式 I/O 系统的文档分为 3 个部分。
这样用户可方便访问自己所需的特定内容。



基本信息

系统手册详细描述了 SIMATIC ET 200SP. 分布式 I/O 系统的组态、安装、接线和调试。
STEP 7 在线帮助为用户提供了组态和编程方面的支持。

设备信息

产品手册中包含模块特定信息的简洁描述，如特性、端子图、功能特性、技术数据。

常规信息

功能手册中包含有关 SIMATIC ET 200SP 分布式 I/O 系统的常规主题的详细描述，如诊断、通信、Web 服务器、设计防干扰型控制器。

可以从 Internet (http://w3.siemens.com/mcms/industrial-automation-systems-simatic/en/manual-overview/tech-doc-et200/Pages/Default.aspx) 上免费下载文档。

产品信息中记录了对这些手册的更改和补充。

相关产品信息，可从 Internet (https://support.industry.siemens.com/cs/cn/zh/view/73021864) 免费下载。

手册集 ET 200SP

手册集中包含 SIMATIC ET 200SP 分布式 I/O 系统的完整文档，这些文档收集在一个文件中。

可以在 Internet (http://support.automation.siemens.com/WW/view/zh/84133942) 上找到手册集。

“mySupport”

通过您的个人工作空间“mySupport”，可以最大程度善用您的工业在线支持服务。

在“mySupport”中，可以存储过滤器、收藏项和标签，请求 CAx 数据以及在“文档”区域汇总您的个人资料库。另外，您的数据可自动填写到支持请求表中，而且您总能从全局上总览您的最新服务请求。

您只需注册一次即可使用“mySupport”的全部功能。

可在 Internet (https://support.industry.siemens.com/My/ww/zh) 上找到“mySupport”。

“mySupport”- 文档

在“mySupport”的“文档”区域，可将完整手册或部分手册组合成自己的手册。
可以 PDF 格式或可编辑格式导出手册。

可在 Internet (http://support.industry.siemens.com/My/ww/zh/documentation) 上找到“mySupport”- 文档。

“mySupport”- CAx 数据

在“mySupport”的“CAx 数据”区域，可访问 CAx 或 CAe 系统的最新产品数据。

仅需几次单击用户即可组态自己的下载包。

用户可选择：

- 产品图片、2 维图、3 维模型、内部电路图、EPLAN 宏文件
- 手册、功能特性、操作手册、证书
- 产品主数据

可在 Internet (http://support.industry.siemens.com/my/ww/zh/CAxOnline) 上找到“mySupport”- CAx 数据。

应用示例

应用示例中包含有各种工具的技术支持和各种自动化任务应用示例。自动化系统中的多个组件完美协作，可组合成各种不同的解决方案，用户因而无需关注各个单独的产品。

有关应用示例，敬请访问 Internet (https://support.industry.siemens.com/sc/ww/zh/sc/2054)。

TIA Selection Tool

通过 TIA Selection Tool，用户可以为全集成自动化（TIA）选择、组态和订购设备。
该工具是 SIMATIC Selection Tool 的下一代产品，并将自动化技术的已知组态程序集成到一个工具中。
通过 TIA Selection Tool，用户可以从产品选择或产品组态中生成一个完整的订购列表。

可以在 Internet (http://w3.siemens.com/mcms/topics/en/simatic/tia-selection-tool) 上找到 TIA Selection Tool。

产品总览

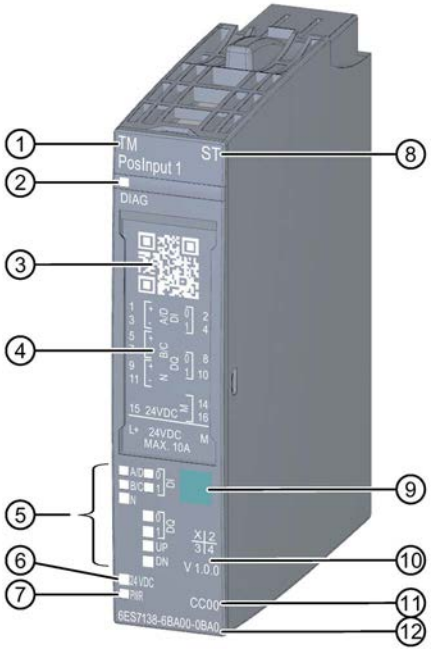
2

2.1 属性

产品编号

6ES7138-6BA00-0BA0

模块视图



① 模块类型和名称
① 诊断 LED
① 2D 矩阵代码
① 接线图
① 通道状态 LED
① 编码器电源 LED
① 电源电压 LED
① 功能类别
① 模块类型颜色编码
① 功能和固件版本
① 选择颜色编码的标签的颜色代码
① 产品编号

图 2-1 TM PosInput 1 模块的视图

属性

工艺模块 TM PosInput 1 具有下列属性：

- 技术特性
  - 一个通道
  - 接口：

    SSI 编码器信号 DAT 和 CLK 或 RS422/TTL 编码器信号 A、B 和 N

    24 V 编码器电源输出，防短路

    数字量输入信号 DI0 和 DI1

    数字量输出信号 DQ0 和 DQ1

    L+ 电源电压
  - 位置值范围：31 位
  - 计数范围：32 位
  - 可组态快速模式
  - 监视编码器信号以判断是否存在断线、短路和偏移电压
  - 硬件中断可组态
  - 可以组态在编码器输入和数字量输入上抑制干扰的输入滤波器
- 支持的编码器/信号类型
  - SSI 绝对编码器
  - 带和不带信号 N 的 RS422/TTL 增量编码器
  - 具有方向信号的 RS422/TTL 脉冲编码器
  - 不具有方向信号的 RS422/TTL 脉冲编码器
  - 用于向上和向下计数脉冲的 RS422/TTL 脉冲编码器
- 支持的系统功能
  - 等时模式
  - 固件更新
  - 标识数据 I&M

附件

以下附件可与模块配合使用，但未包含在产品包中：

- 标签条
- 颜色标识标签
- 参考标识标签
- 屏蔽层连接器

要操作工艺模块，需要 A0 类型的 BaseUnit 。有关可以与工艺模块配合使用的 BaseUnits 的概述，请参见 ET 200SP 分布式 I/O 系统文档中的产品信息 (http://support.automation.siemens.com/WW/view/zh/73021864)。

有关安装过程的详细信息，请参见系统手册 ET 200SP 分布式 I/O 系统 (http://support.automation.siemens.com/WW/view/zh/58649293)。

2.2 功能

2.2.1 采集编码器信号

2.2.1.1 采用 SSI 绝对编码器的定位输入

可使用 TM PosInput 1 工艺模块与 SSI 绝对编码器实现定位输入。工艺模块通过 SSI 绝对编码器的同步串行接口读取位置，然后将其发送到控制器。

可在定义的位置值处准确切换工艺模块的数字量输出，而与用户程序无关。采用 SSI 绝对编码器的定位输入并不涉及门控制。

格雷码-二进制码转换

支持格雷码和二进制码 SSI 绝对编码器。

位置值范围

可为 SSI 绝对值编码器指定 10 位到 40 位的帧长度。帧中位置值的 LSB 和 MSB 位的可组态位数决定了值范围。工艺模块可读取最长 31 位的位置值并将其传送至 PLC。该位置值被视作无符号正值，取值范围介于 0 和 $2^{(MSB-LSB+1)}-1$ 之间。

完整 SSI 帧

可以不返回测量变量，而是选择返回当前未处理的 SSI 帧的 32 个最低有效位。因此还可在位置值之外向用户提供编码器特定的其它位，例如错误位。如果 SSI 帧短于 32 位，则在反馈接口中以右对齐的方式返回完整 SSI 帧，未使用的高位则返回为“0”。

Capture (Latch)

可使用数字量输入的边沿将当前位置值保存为 Capture 值。Capture 功能可由上升沿、下降沿单独触发或两种沿同时触发。

滞后

可指定比较值滞后，在此范围内可防止重新切换数字量输出。编码器可能稳定在特定位置上，且轻微运动可使位置值围绕此位置波动。如果比较值或位置限值介于此波动范围内，在未使用滞后的情况下，将以相应频率接通和切断相应的数字量输出。滞后可防止这些不必要的切换操作。

2.2.1.2 用增量编码器或脉冲编码器计数

计数是指对事件进行记录和统计。工艺模块的计数器检测编码器信号和脉冲，并对其进行相应的评估。可以使用编码器或脉冲信号或通过用户程序指定计数方向。

可以通过数字量输入控制计数过程。

可利用下述功能指定计数器的特性。

计数限值

计数限值定义使用的计数器值范围。计数限值可以组态，并且可在运行期间通过用户程序进行修改。

可能的最大计数限值为 2147483647 (2^{31}–1)。可能的最小计数限值为 –2147483648 (–2^{31})。

可组态计数器在达到计数限值时的响应：

- 超出计数限值时继续或停止计数（自动门停止）
- 超出计数限值时将计数器值设置为起始值或其它计数限值

起始值

可在计数限值内组态起始值。运行期间可以通过用户程序修改起始值。

根据参数分配，工艺模块可在同步时、Capture 功能激活时、超出计数限值时或打开门时将当前计数器值设置为起始值。

门控制

硬件门和软件门的开关决定了执行计数信号捕获的时间段。

从外部通过工艺模块的数字量输入进行硬件门控制。通过用户程序进行软件门控制。可通过参数分配启用硬件门。不能禁用软件门（循环 I/O 数据控制接口中的位）。

Capture (Latch)

可组态外部基准信号沿以触发将当前计数器值保存为 Capture 值。以下外部信号可触发 Capture 功能：

- 数字量输入的上升沿或下降沿
- 数字量输入的两种沿
- 编码器输入上信号 N 的上升沿

使用数字量输入时，可指定在执行 Capture 功能后是从当前计数器值还是从起始值继续计数。当使用编码器输入上的 N 信号的上升沿时，计数操作从 Capture 功能得出的当前计数值继续进行。

同步

可组态外部基准信号沿以使用指定的起始值加载计数器。以下外部信号可触发同步：

- 数字量输入的上升沿或下降沿
- 编码器输入上信号 N 的上升沿
- 取决于已分配数字量输入电平的编码器输入上的信号 N 的上升沿

滞后

可指定比较值滞后，在此范围内可防止重新切换数字量输出。编码器可能稳定在特定位置上，且轻微运动可使计数器值围绕此位置波动。如果比较值或计数限值介于此波动范围内，在未使用滞后的情况下，将以相应频率接通和切断相应的数字量输出。滞后可防止这些不必要的切换操作。

2.2.2 测量值测定

可以使用下列测量功能：

测量类型	说明
频率测量	平均频率将根据计数脉冲或位置值变化的时间曲线以设置的测量间隔计算得出，并采用赫兹单位以浮点数形式返回。
周期测量	平均周期持续时间每隔所设置的测量间隔计算一次，计算将以计数脉冲或位置值变化的时间曲线为基础，并将返回为以秒为单位的浮点数。
速度测量	平均速度将根据计数脉冲或位置值变化的时间曲线和其它参数以设置的测量间隔计算得出，并以组态的测量单位返回。

测量值和计数器值在反馈接口中同时提供。选择 SSI 绝对编码器时，可以不返回测量变量，而是选择返回当前未处理的 SSI 帧的 32 个最低有效位。

更新时间

您可以将工艺模块循环更新测量值的时间间隔组态为更新时间。 设置较长的更新时间可以使不均匀的测量变量趋于平滑并提高测量精度。

增量编码器和脉冲编码器的门控制

硬件门和软件门的开关决定了执行计数信号捕获的时间段。 更新时间与门的打开异步，即当门打开时并不启动更新时间。 关闭后，继续返回捕获的最后一个测量值。

测量范围

测量功能具有以下测量范围限值：

测量类型	测量范围下限	测量范围上限
频率测量	0.04 Hz	4 MHz*
周期测量	0.25 µs*	25 s
速度测量	取决于“每个单位的增量数”和“速度测量的时间基数”的组态数字	

* 适用于增量编码器和“四重”信号评估。

所有测量值都返回为有符号的值。 通过符号指示相关时段内计数器值或位置值是增加还是减少。

2.2.3 以比较值切换输出

定义两个比较值，这两个值可控制独立于用户程序的两个数字量输出。 比较值可以组态，并且可在运行期间通过用户程序进行修改。

计数模式下的比较值

根据编码器的不同，可在计数模式下定义两个位置值或计数器值作为比较值。 如果当前位置值或计数器值符合组态的比较条件，则可以设置相应数字量输出以直接在该过程中启动控制过程。

测量模式下的比较值

在测量模式下定义两个比较值。 如果当前的测量值符合组态的比较条件，则可以设置相应数字量输出以直接在该过程中启动控制过程。

2.2.4 运动控制的定位输入

可使用带 S7-1500 Motion Control 的工艺模块进行定位输入。

在 STEP 7 (TIA Portal) 的工艺模块的设备组态中，选择“Motion Control 的定位输入”模式。

使用增量编码器或脉冲编码器时，基于工艺模块的计数功能进行定位输入。使用 SSI 绝对编码器时，绝对值通过同步串行接口读取并根据参数分配进行准备以应用于 S7-1500 Motion Control。

更多信息

有关 Motion Control 的使用及其组态的详细说明，请参见 S7-1500 Motion Control 功能手册，该手册可从 Internet (http://support.automation.siemens.com/WW/view/zh/59381279) 下载。

2.2.5 快速模式

可以使用快速模式中的工艺模块快速检测使用压缩功能时的数值或位置值。在快速模式下可以访问简化的反馈接口，而非控制接口。这意味着可以针对 CPU 使用较为短暂的传送时钟。

工艺模块的函数范围在快速模式下存在以下额外限制：

- 仅可使用数据记录 128 更改 RUN 中的参数
- 计数/位置取值范围：25 位
- 未提供测量值：
- 未提供软件门：
- 未提供完整 SSI 帧：
- 未提供 Capture 功能
- 未提供硬件中断
- 合并自动确认的错误消息（反馈位）

为此，在 STEP 7 (TIA Portal) 的工艺模块的设备组态中，选择“快速模式”操作模式。

2.2.5.1 使用 SSI 绝对编码器的快速模式

可使用带有 SSI 绝对编码器的工艺模块实现定位输入。工艺模块通过 SSI 绝对编码器的同步串行接口读取位置值，然后将其用于控制器。

可在定义的位置值处准确切换工艺模块的数字量输出，而与用户程序无关。仅可使用 RUN 中的数据记录 128 更改比较值。采用 SSI 绝对编码器的定位输入并不涉及门控制。

格雷码-二进制码转换

支持格雷码和二进制码 SSI 绝对编码器。

位置值范围

可为 SSI 绝对值编码器指定 10 位到 40 位的帧长度。帧中位置值的 LSB 和 MSB 位的可组态位数决定了值范围。工艺模块最长可读取 25 位位置值并将其传送至控制器。该位置值被视作无符号正值，取值范围介于 0 和 $2^{(MSB-LSB+1)}-1$ 之间。

滞后

可指定比较值滞后，在此范围内可防止重新切换数字量输出。编码器可能稳定在特定位置上，且轻微运动可使位置值围绕此位置波动。如果比较值或位置限值介于此波动范围内，在未使用滞后的情况下，将以相应频率接通和切断相应的数字量输出。滞后可防止这些不必要的切换操作。

2.2.5.2 带有增量或脉冲编码器的快速模式

计数是指对事件进行记录和统计。工艺模块的计数器检测编码器信号和脉冲，并对其进行相应的评估。可使用编码器或脉冲信号指定计数方向。

可以通过数字量输入控制计数过程。

在快速模式下使用增量编码器或脉冲编码器时，可利用下述功能指定计数器特性。

计数限值

计数限值定义使用的计数器值范围。计数器限值可以组态，并且可在运行期间通过数据记录 128（而非控制接口）进行修改。

可能的最大计数限值为 33554431 (2^{25}–1)。可能的最小计数限值为 0。

可组态计数器在达到计数限值时的响应：

- 超出计数限值时继续或停止计数（自动门和已组态硬件门同时停止）
- 超出计数限值时将计数器值设置为起始值或其它计数限值

起始值

可在计数限值内组态起始值。运行期间仅可通过数据记录 128 修改起始值。

根据参数分配，工艺模块可在同步、超出计数限值或已组态硬件门打开时将当前计数器值设置为起始值。

门控制

硬件门（HW 门）的开关决定了执行计数信号记录的时间段。

从外部通过工艺模块的数字量输入进行硬件门控制。可通过参数分配启用硬件门。如果未组态硬件门，则将记录所有计数信号。未提供软件门：

同步

可组态外部基准信号沿以使用指定的起始值加载计数器。以下外部信号可触发同步：

- 数字量输入的上升沿或下降沿
- 编码器输入上信号 N 的上升沿
- 取决于已分配数字量输入电平的编码器输入上的信号 N 的上升沿

滞后

可指定比较值滞后，在此范围内可防止重新切换数字量输出。编码器可能稳定在特定位置上，且轻微运动可使计数器值围绕此位置波动。如果比较值或计数限值介于此波动范围内，在未使用滞后的情况下，将以相应频率接通和切断相应的数字量输出。滞后可防止这些不必要的切换操作。

2.2.6 附加功能

硬件中断

例如，如果发生比较事件，在出现过零和/或计数方向改变（反向）的情况下，工艺模块可以在 CPU 中触发硬件中断。可以指定运行期间哪些事件 (页 73)将触发硬件中断。

诊断中断

例如在缺少电源电压或数字量输出出现错误时，工艺模块可触发诊断中断。在设备组态中自由选择诊断中断 (页 71)。

监视编码器信号

工艺模块监视编码器的信号以判断是否存在断线、短路和偏移电压。对于 SSI 绝对值编码器，工艺模块还会监视 SSI 帧是否有误。

如果启用诊断中断，则在出现相应错误时，工艺模块将触发诊断中断。

输入滤波器

为了抑制干扰，可为 RS422/TTL 编码器输入和数字量输入组态输入滤波器。

分布式应用

通过使用 ET 200SP 分布式 I/O 系统中的接口模块，可以在分布式组态中使用工艺模块。可进行以下应用：

- S7-1500 系统中的分布式运行
- S7-1200 系统中的分布式运行
- S7-300/400 系统中的分布式运行
- 第三方系统中的分布式运行

等时模式

工艺模块在分布模式下支持“等时模式”系统功能。此系统功能允许以定义的系统周期记录位置、计数器和测量值。

在等时模式中，用户程序的周期、输入信号的传输以及工艺模块中的处理都将同步。如果满足相关的比较条件，则输出信号将立即切换。数字量输入的状态改变会立即影响工艺模块的计划响应，并更改反馈接口 (页 55)中数字量输入的状态位。

数据处理

在当前总线周期中通过控制接口传送至工艺模块的数据将在内部工艺模块周期中处理时生效。T_i 时将捕获位置值或计数器值，还会根据需要将捕获测量值以及状态位，这些信息可以在反馈接口中提供以便在当前总线周期中进行检索。

在等时模式下，在反馈接口中的所有字节都保持数据一致。

更多信息

有关等时模式的详细说明，请参见使用 STEP 7 组态 PROFINET 功能手册。该手册可从 Internet (https://support.industry.siemens.com/cs/cn/zh/view/49948856) 下载。

接线

3

3.1 针脚分配

TM PosInput 1 与 A0 类型的 BaseUnit 结合使用。

编码器信号、数字量输入和输出信号以及编码器电源连接到工艺模块的 BaseUnit。相关电位组的光 BaseUnit BU...D 上馈送的电源电压为模块和数字量输出供电，并生成编码器电源电压。

BaseUnit

BaseUnit 不包含在模块的产品包内，必须单独订购。

有关可以与工艺模块配合使用的 BaseUnits 的概述，请参见 ET 200SP 分布式 I/O 系统文档中的产品信息 (http://support.automation.siemens.com/WW/view/zh/73021864)。

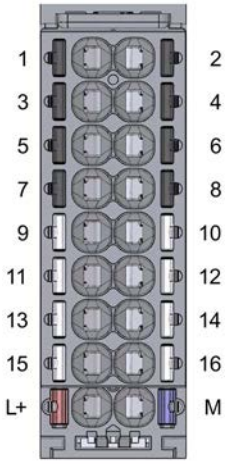
有关选择合适的 BaseUnit 的信息，请参见 ET 200SP 分布式 I/O 系统 (http://support.automation.siemens.com/WW/view/zh/58649293)系统手册和 ET 200SP BaseUnit (http://support.automation.siemens.com/WW/view/zh/58532597/133300) 设备手册。

有关 BaseUnit 接线、连接电缆屏蔽等的信息，请参见 ET 200SP 分布式 I/O 系统 (http://support.automation.siemens.com/WW/view/zh/58649293)系统手册的连接部分。

BaseUnit 的引脚分配

下表以 BaseUnit BU15-P16+A0+2B 为例显示了引脚分配情况。

表格 3- 1　BaseUnit BU15-P16+A0+2B 的引脚分配

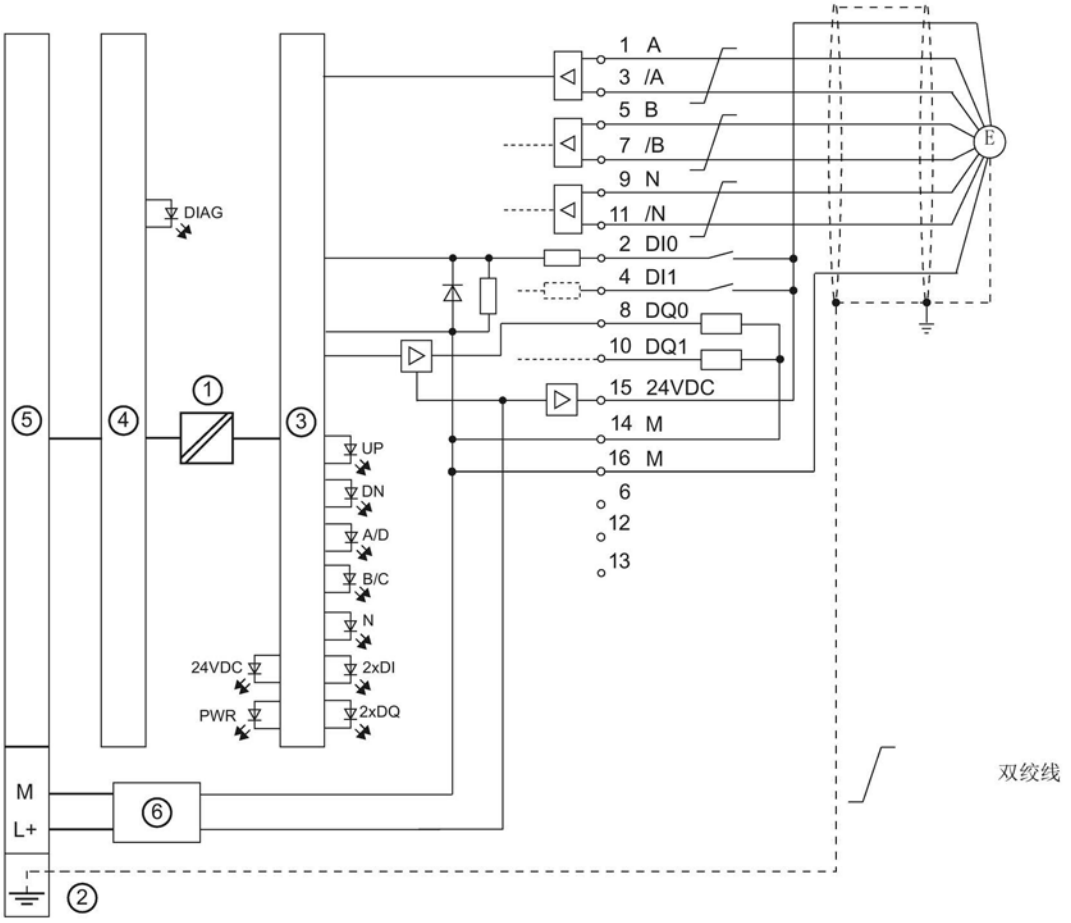
视图	信号名称		名称					
			RS422/TTL 增量编码器		**RS422/TTL 脉冲编码器**			**SSI 绝对编码器**
			有信号 N	**无信号 N**	**有方向信号**	**无方向信号**	**向上/向下**	
	1	A 或 D	编码器信号 A		计数信号 A		向上计数信号 A	SSI 数据信号 DAT
	3	/A 或 /D	编码器信号 /A（仅 RS422）		计数信号 /A（仅 RS422）		向上计数信号 /A（仅 RS422）	SSI 数据信号 /DAT
	5	B 或 C	编码器信号 B		方向信号 B	—	向下计数信号 B	SSI 时钟信号 CLK
	7	/B 或 /C	编码器信号 /B（仅 RS422）		方向信号 /B（仅 RS422）		向下计数信号 /B（仅 RS422）	SSI 时钟信号 /CLK
	9	N	编码器信号 N	—				
	11	/N	编码器信号 /N（仅 RS422）	—				

视图	信号名称		名称					
			RS422/TTL 增量编码器		**RS422/TTL 脉冲编码器**			**SSI 绝对编码器**
			有信号 N	**无信号 N**	**有方向信号**	**无方向信号**	**向上/向下**	
	2	DI0	数字量输入 DI0					
	4	DI1	数字量输入 DI1					
	8	DQ0	数字量输出 DQ0					
	10	DQ1	数字量输出 DQ1					
	6	—	—					
	12	—	—					
	13	—	—					
	电源电压、编码器电源和接地							
	15	24VDC	24 V 编码器电源					
	14	M	编码器电源、数字量输入和数字量输出的接地					
	16	M						
		L+	DC 24V 电源电压					
		M	电源电压的接地					

方框图

必须通过 BaseUnit 上和编码器上的屏蔽端子（屏蔽托架和端子）将编码器与工艺模块之间的电缆屏蔽层接地。

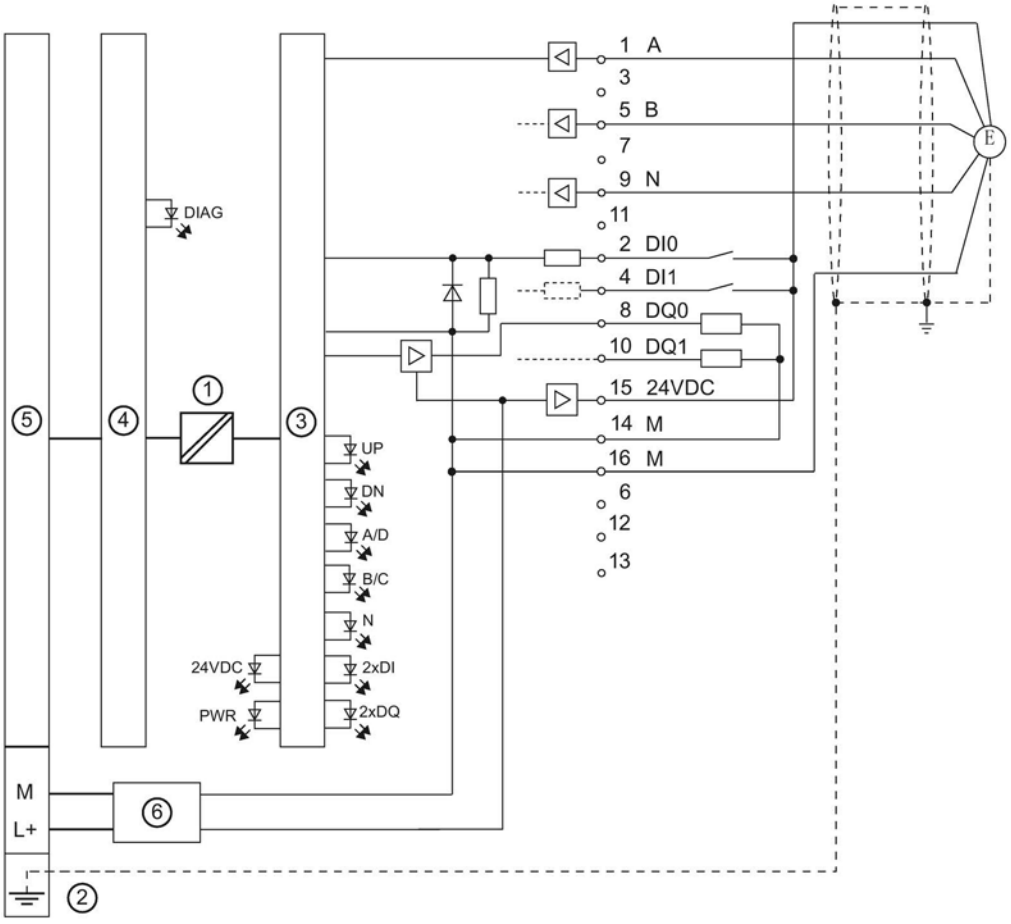
下图显示了与一个 RS422 增量编码器相连的工艺模块的方框图。



① 电气隔离
① BaseUnit 上的屏蔽连接
① 工艺
① 工艺模块的背板总线接口模块
① 背板总线
① 输入滤波器

图 3-1 带 RS422 增量编码器的方框图

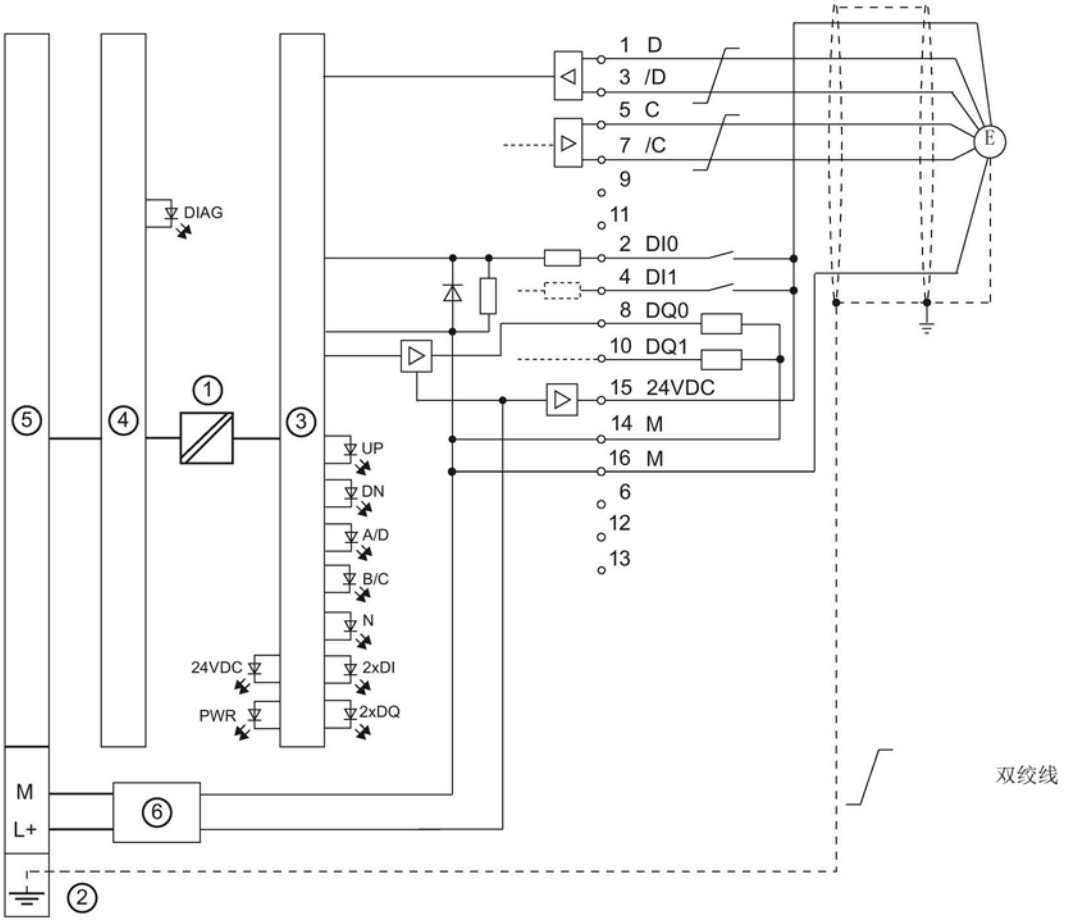
下图显示了与一个 TTL 增量编码器相连的工艺模块的方框图。



① 电气隔离
① BaseUnit 上的屏蔽连接
① 工艺
① 工艺模块的背板总线接口模块
① 背板总线
① 输入滤波器

图 3-2 带 TTL 增量编码器的方框图

下图显示了与一个 SSI 绝对编码器相连的工艺模块的方框图。



① 电气隔离
① BaseUnit 上的屏蔽连接
① 工艺
① 工艺模块的背板总线接口模块
① 背板总线
① 输入滤波器

图 3-3 带 SSI 绝对编码器的方框图

L+/M 电源电压

将电源电压 (DC 24V) 连接到 L+ 和 M 接头。内部保护电路可保护工艺模块免受电源电压反极性的影响。工艺模块可监视电源电压的连接。

24VDC 编码器电源

要为数字量输入上的编码器和传感器供电，工艺模块在 24VDC 输出处提供 DC 24V 电源电压（相对于 M）。从 L+/M 电源电压提供电压，并监视电压是否短路及过载。

RS422/TTL 编码器信号/计数信号和 SSI 编码器信号

TM PosInput 1 可处理计数或 SSI 编码器信号。计数编码器信号通过 A、B 和 N 标识，并使用 RS422 或 TTL 信号标准。SSI 编码器信号通过 DAT（字母 D）和 CLK（字母 C）标识，并使用 RS422 信号标准。

采用 TTL 标准的编码器信号使用单电缆。RS422 编码器信号使用一个电缆对，计数/SSI 信息以差分电压形式传输。这样可确保即使对于高频 RS422 编码器信号，也可实现长距离无干扰传输。每个 RS422 线对在电缆中必须绞结在一起。

可连接以下编码器类型：

- SSI 绝对编码器：

  SSI 编码器信号 CLK 和 DAT 均通过端子 C 和 D 连接。端子 N 保持未连接状态。

- 具有信号 N 的 RS422/TTL 增量编码器：

  编码器信号 A、B 和 N 通过相应标记的端子进行连接。A 和 B 是通过将相移 90° 得到的两个增量信号。N 是每转返回一个脉冲的零标记信号。

- 不具有信号 N 的 RS422/TTL 增量编码器：

  编码器信号 A 和 B 通过相应标记的端子进行连接。A 和 B 是通过将相移 90° 得到的两个增量信号。端子 N 保持未连接状态。

- 不具有方向信号的 RS422/TTL 脉冲编码器：

  该计数信号将连接至端子 A。计数方向通过控制接口指定。端子 B 和 N 保持未连接状态。

- 具有方向信号的 RS422/TTL 脉冲编码器：

  该计数信号将连接至端子 A。该方向信号将连接至端子 B。端子 N 保持未连接状态。

- 具有向上/向下计数信号的 RS422/TTL 脉冲编码器：

  该向上计数信号将连接至端子 A。该向下计数信号将连接至端子 B。端子 N 保持未连接状态。

输入之间互不电气隔离。这些输入与背板总线隔离。

说明

RS422 信号标准提供的抗干扰度高于 TTL 信号标准。如果您的增量编码器或脉冲编码器支持 RS422 和 TTL 信号标准，建议您使用 RS422 信号标准。

增量编码器和脉冲编码器 RS422/TTL 信号的输入滤波器

为了抑制干扰，可为编码器输入 A、B 和 N 来组态输入滤波器。所选滤波频率基于 40:60 和 60:40 之间的脉冲-中断比。这将生成特定的最短脉冲/中断时间。将抑制宽度短于最短脉冲时间/中断时间的信号变化。

可以为滤波频率指定下列值：

表格 3- 2　滤波频率和相应的最短脉冲/中断时间

滤波频率	最短脉冲时间/中断时间
100 Hz	4.0 ms
200 Hz	2.0 ms
500 Hz	800 µs
1 kHz	400 µs
2 kHz	200 µs
5 kHz	80 µs
10 kHz	40 µs
20 kHz	20 µs
50 kHz	8.0 µs
100 kHz	4.0 µs
200 kHz	2.0 µs

滤波频率	最短脉冲时间/中断时间
500 kHz	0.8 µs
1 MHz （默认值）	0.4 µs

数字量输出 DI0 和 DI1

有两个数字量输出可用。数字量输入用于门控制、同步和 Capture 功能。此外，也可以在不对功能进行命名情况下使用一个或两个数字量输入，并通过反馈接口读取相应数字量输入的信号状态。

数字量输入之间互不电气隔离。

数字量输入的输入滤波器

要抑制干扰，可为数字量输入组态输入延迟。

可为输入延迟指定以下值：

- 无
- 0.05 ms
- 0.1 ms（默认值）
- 0.4 ms
- 0.8 ms
- 1.6 ms
- 3.2 ms
- 12.8 ms
- 20 ms

说明

如果选择“无”或“0.05 ms”选项，则必须使用屏蔽电缆来连接数字量输入。

数字量输出 DQ0 和 DQ1

存在两个数字量输出。通过指定的比较值或用户程序，可以直接激活/切换两个数字量输出 DQ0 和 DQ1 。

数字量输出之间互不隔离。

这些数字量输出为相对于 M 的 24 V 源型输出，可承受 0.5 A 的额定负载电流。它们均具有过载和短路保护功能。

说明

可以直接连接继电器和接触器而无需外部电路。有关可能的最大工作频率和数字量输出上的感性负载的信息，请参见技术规范 (页 74)部分。

组态/地址空间

4

4.1 组态

简介

使用组态软件为工艺模块组态和分配参数。

通过用户程序控制和监视工艺模块功能。

系统环境

工艺模块可以在下列系统环境中使用：

应用	所需组件	组态软件	在用户程序中
S7-1500 系统中的分布式运行	• S7-1500 自动化系统 • ET 200SP 分布式 I/O 系统 • TM PosInput 1	STEP 7（TIA 门户）： • 使用硬件组态进行设备组态 • 使用工艺对象（例如 High_Speed_Counter）进行参数设置	采用 SSI 绝对编码器的定位输入： 直接在 I/O 数据中访问 TM PosInput 1 的控制和反馈接口 (页 51) 计数与测量功能： 工艺对象的 High_Speed_Counter 指令
		STEP 7（TIA 门户）： 在“Motion Control 的定位输入”操作模式下，使用硬件组态进行设备组态	由 Motion Control 类别的轴工艺对象控制
		STEP 7 (TIA Portal)： 在“快速模式”操作模式下，使用硬件组态进行设备组态	直接访问 I/O 数据中 TM PosInput 1 的反馈接口 (页 57)

应用	所需组件	组态软件	在用户程序中
S7-300/400 或 S7-1200 系统中的分布式运行	• S7-300/400 或 S7-1200 自动化系统 • ET 200SP 分布式 I/O 系统 • TM PosInput 1	STEP 7（TIA 门户）： 使用硬件组态进行设备组态和参数组态 STEP 7： 使用 HSP 进行设备组态和参数设置	直接在 I/O 数据中访问 TM PosInput 1 的控制和反馈接口 (页 51)
第三方系统中的分布式运行	• 第三方自动化系统 • ET 200SP 分布式 I/O 系统 • TM PosInput 1	第三方组态软件： 使用 GSD 文件进行设备组态和参数设置	直接在 I/O 数据中访问 TM PosInput 1 的控制和反馈接口 (页 51)

更多信息

有关计数和测量功能及其组态的详细说明在如下位置提供：

- “计数、测量和定位输入”功能手册，该手册可从 Internet (http://support.automation.siemens.com/WW/view/zh/59709820) 下载
- 位于 STEP 7 (TIA Portal) 信息系统的“使用工艺功能 > 计数、测量和定位输入 > 计数、测量和定位输入 (S7-1500)”下

有关 Motion Control 的使用及其组态的详细说明，可参见：

- “S7-1500 运动控制”功能手册，该手册可从 Internet (http://support.automation.siemens.com/WW/view/zh/59381279) 下载
- STEP 7（TIA 门户）信息系统的“使用工艺功能 > 运动控制 > 运动控制（S7-1200 和 S7-1500）”下

硬件支持包

如果您的 TIA Portal 版本中不含集成工艺模块，则可使用 HSP0184 集成 TIA Portal V13 SP1。

硬件支持包 (HSP) 可从 Internet (https://support.industry.siemens.com/cs/ww/zh/view/72341852) 下载。

GSD 文件

ET 200SP 分布式 I/O 系统的 或 GSD 文件可从 Internet 下载：

- GSD 文件 PROFINET IO (http://support.automation.siemens.com/WW/view/zh/57138621)
- GSD 文件 PROFIBUS DP (http://support.automation.siemens.com/WW/view/zh/73016883)

参见

参数 (页 40)

4.2 对 CPU STOP 模式的响应

对 CPU STOP 模式的响应

在设备组态的基本参数中，设置工艺模块对每个通道的 CPU STOP 的响应。

表格 4- 1　工艺模块根据参数分配对 CPU STOP 的响应

基本参数	对 CPU STOP 模式的响应
继续工作	工艺模块仍具有全部功能。处理传入计数脉冲或读取位置值。数字量输出根据参数分配继续进行切换。
输出替换值	工艺模块在数字量输出上输出组态的替换值，直到下一次 CPU STOP-RUN 转换。 发生 STOP-RUN 转换后，工艺模块返回到其启动状态：计数器值设置为起始值（适用于增量编码器或脉冲编码器），数字量输出根据参数分配进行切换。
保持上一个值	工艺模块在数字量输出上输出转换到 STOP 状态时有效的值，并保持该值，直到发生下一次 CPU STOP-RUN 转换为止。 如果在 CPU 停止时将具有“如果比较值持续一个脉冲宽度”功能的数字量输出置位，则经过一个脉冲宽度后此数字量输出复位。 发生 STOP-RUN 转换后，工艺模块返回到其启动状态：计数器值设置为起始值（适用于增量编码器或脉冲编码器），数字量输出根据参数分配进行切换。

4.3 地址空间

工艺模块的地址空间

表格 4- 2 TM PosInput 1 输入地址和输出地址的范围

	输入	输出
范围	16 字节	12 字节

表格 4- 3 “Motion Control 定位输入”模式下 TM PosInput 1 输入地址和输出地址的范围

	输入	输出
范围	16 字节	4 字节

表格 4- 4 “快速模式”操作模式中 TM PosInput 1 的输入地址和输出地址范围

	输入	输出
范围	4 字节	0 字节

更多信息

有关如何使用 TM PosInput 1 的控制和反馈接口的说明，请参见控制和反馈接口 (页 51) 部分。

4.4 参数

可使用多种参数来定义工艺模块的属性。根据设置的不同，并非所有参数均可用。可使用数据记录 128 (页 85)在用户程序中更改参数分配。

以下选项可用于设置模块参数：

参数设置选项	基本操作步骤
STEP 7 (TIA Portal) 中的硬件组态和工艺对象	1. 在硬件配置中设置设备组态。 必须将“工艺对象的工作”设置为工作模式。 2. 使用工艺对象分配参数。 3. 将参数分配下载到模块中。
STEP 7 （TIA 门户）中的硬件配置	1. 在硬件配置中设置设备组态。 必须将“手动操作”、“快速模式”或“Motion Control 的定位输入”设置为操作模式。 2. 在硬件配置中设置参数。 3. 将参数分配下载到模块中。
STEP 7 中的硬件配置，使用 HSP 文件	1. 安装相应的 HSP 文件。 之后可在硬件目录中的“ET 200SP”下找到该模块。 2. 在硬件配置中设置设备组态和参数。 3. 将参数分配下载到模块中。
使用 GSD 文件的硬件配置，针对 PROFINET IO 上的分布式运行	1. 安装最新的 PROFINET GSD 文件。 之后可在硬件目录 中的“其它现场设备”下找到模块。 2. 在硬件配置中设置 PROFINET GSD 文件参数。 3. 将参数分配下载到模块中。
使用 GSD 文件的硬件配置，针对 PROFIBUS DP 上的分布式运行	1. 安装最新的 PROFIBUS GSD 文件。 之后可在硬件目录 中的“其它现场设备”下找到模块。 2. 在硬件配置中设置 PROFIBUS GSD 文件的参数。 下表中带有 [1] 高亮显示的参数不在 PROFIBUS GSD 文件中进行组态。 3. 将参数分配下载到模块中。 此操作将下载下表中标记为 [1] 的参数以及默认设置。可使用数据记录 128 (页 85)在用户程序中更改这些参数。

下表中列出了各参数。

适用于增量编码器或脉冲编码器的 TM PosInput 1 的参数

如果使用增量编码器或脉冲编码器，则可以设置以下参数：

表格 4- 5　可组态的参数及其默认值

参数	值范围	默认设置	在 RUN 模式下重新组态
工作模式	• 计数 • 测量	计数	-
接口标准	• RS422，对称 • TTL (5 V)，非对称	RS422，对称	√
对 CPU STOP 模式的响应 [1]	• 输出替换值 • 保持上一个值 • 继续工作	输出替换值	√
启用断线诊断中断 [2]	• 取消激活 • 激活	取消激活	√
启用附加诊断中断	• 取消激活 • 激活	取消激活	√
信号类型	• 脉冲 (A) • 脉冲 (A) 和方向 (B) • 向上计数 (A)，向下计数 (B) • 增量编码器（A、B 相移） • 增量编码器（A、B、N）	脉冲 (A) 和方向 (B)	√
计数器输入的信号评估	• 单重 • 双重 • 四重	单重	√

参数	值范围	默认设置	在 RUN 模式下重新组态
计数器输入的滤波器频率 [1]	• 100 Hz • 200 Hz • 500 Hz • 1 kHz • 2 kHz • 5 kHz • 10 kHz • 20 kHz • 50 kHz • 100 kHz • 200 kHz • 500 kHz • 1 MHz	1 MHz	√
反转方向（计数器输入）[1]	• 取消激活 • 激活	取消激活	√
对信号 N 有响应 [1]	• 对信号 N 无响应 • 在信号 N 处同步 • 信号 N 出现时的 Capture	对信号 N 无响应	√
基准标记 0 的信号选择 [3]	• DI0 • 增量编码器的信号 N	DI0	支持
硬件中断：门启动 [1]	• 取消激活 • 激活	取消激活	√
硬件中断：门停止 [1]	• 取消激活 • 激活	取消激活	√
硬件中断：上溢（超出计数上限）[1]	• 取消激活 • 激活	取消激活	√
硬件中断：下溢（超出计数器下限）[1]	• 取消激活 • 激活	取消激活	√

参数	值范围	默认设置	在 RUN 模式下重新组态
硬件中断：更改方向 [1]	• 取消激活 • 激活	取消激活	√
硬件中断：发生了 DQ0 的比较事件 [1]	• 取消激活 • 激活	取消激活	√
硬件中断：发生了 DQ1 的比较事件 [1]	• 取消激活 • 激活	取消激活	√
硬件中断：零点 [1]	• 取消激活 • 激活	取消激活	√
硬件中断：新的 Capture 值可用 [1]	• 取消激活 • 激活	取消激活	√
硬件中断：通过外部信号同步计数器 [1]	• 取消激活 • 激活	取消激活	√
设置输出	• 由用户程序使用 • 在比较值和上限之间 • 比较值和计数器下限之间 • 在比较值持续一个脉宽时间 • 在 CPU 发出置位命令后，达到比较值之前 • 比较值 0 和 1 之间 • 不在比较值 0 和 1 之间 • 无功能的数字量输出 [4]	DQ0、DQ1：在比较值和上限之间 （快速模式：无功能的数字量输出）	√
DQ 的替代值 [1]	• 0 • 1	DQ0、DQ1：0	√
DQ 功能 [1] 的 计数方向	• 向上 • 向下 • 两个方向均比较	两个方向均比较	√
脉冲宽度 [ms/10][1]	0...65535	5000 （对应于 0.5 s）	√

参数	值范围	默认设置	在 RUN 模式下重新组态
设置 DI 的功能	• 门启动/停止（电平触发） • 门启动（沿触发） • 门停止（沿触发） • 同步 • 在信号 N 处启用同步 • Capture • 无功能的数字量输入	• DI0：门启动/停止（电平触发） • DI1：无功能的数字量输入	√
为 DI[1] 选择电平	• 高电平激活 • 低电平激活	高电平激活	√
为 DI[1] 选择边沿	• 在上升沿 • 下降沿 • 上升沿和下降沿	在上升沿	√
Capture DI[1] 后的计数器值特性	• 继续计数 • 设为起始值并继续计数	继续计数	√
数字量输入 [1] 的输入延迟	• 无 • 0.05 ms • 0.1 ms • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms	0.1 ms	√
同步频率 [1]	• 一次 • 周期性	一次	√
同步计数方向 [4]	• 向上 • 向下 • 双向计数	向上	支持

参数	值范围	默认设置	在 RUN 模式下重新组态
计数上限 [1]	-2147483647...2147483647 （快速模式：1...33554431）	2147483647 （快速模式：33554431）	√
比较值 0[1]	-2147483648...2147483647 （快速模式：0...33554431）	0	√
比较值 1[1]	-2147483648...2147483647 （快速模式：0...33554431）	10	√
起始值 [1]	-2147483648...2147483647 （快速模式：0...33554431）	0	√
计数下限 [1]	-2147483648...2147483646 （快速模式：0...33554430）	-2147483648 （快速模式：0）	√
超出计数限值时重置	• 至另一个计数限值 • 至起始值	至另一个计数限值	√
对超出计数限值的响应	• 停止计数 • 继续计数	继续计数	√
对门启动的响应	• 设为起始值 • 以当前值继续	以当前值继续	√
测量变量	• 频率 • 周期 • 速度	频率	√
测量功能的更新时间 [µs] [1]	0...25000000	10000（对应于 10 ms）	√
速度测量的时间基数 [1]	• 1 ms • 10 ms • 100 ms • 1 s • 60 s/1 min	60 s/1 min	√
每单位增量数 [1]	1...65535	1	√
滞后 [1]	0...255	0	√

参数	值范围	默认设置	在 RUN 模式下重新组态
步进/转：[3]	1...65535	1	√
参考速度 [3] [10^{-2} rpm]	600...21000000	300000（对应于 3000 rpm）	√
电位组	• 使用左边模块的电位组（深色 BaseUnit） • 启用新电位组（浅色 BaseUnit）	使用左边模块的电位组（深色 BaseUnit）	-

[1] 此参数不能通过 PROFIBUS GSD 文件进行组态。该参数随默认设置一起被下载至模块，并且可使用数据记录 128 进行调整。

[2] 使用 GSD 文件时，此诊断中断由“启用其它诊断中断”参数激活，且不能单独设置。

[3] 仅在“Motion Control 的定位输入”操作模式下可用

[4] 仅在“快速模式”操作模式下可用

适用于 SSI 绝对编码器的 TM PosInput 1 的参数

如果使用 SSI 绝对编码器，则可以设置以下参数：

表格 4- 6　可组态的参数及其默认值

参数	值范围	默认设置	在 RUN 模式下重新组态
工作模式	• 计数 • 测量	计数	-
对 CPU STOP 模式的响应 [1]	• 输出替换值 • 保持上一个值 • 继续工作	输出替换值	√
启用附加诊断中断	• 取消激活 • 激活	取消激活	√
启用断线诊断中断 [2]	• 取消激活 • 激活	取消激活	√
单稳态触发器时间 [1]	• 自动 • 16 µs • 32 µs • 48 µs • 64 µs	自动	√
代码类型	• 格雷码 • 二进制码	格雷码	√
奇偶校验	• 无 • 偶校验 • 奇校验	无	√
反转方向（位置值）[1]	• 取消激活 • 激活	取消激活	√

参数	值范围	默认设置	在 RUN 模式下重新组态
传输率	• 125 kHz • 250 kHz • 500 kHz • 1 MHz • 1.5 MHz • 2 MHz	125 kHz	√
帧长度	10 位至 40 位	13 位	√
位置值的 LSB 位号	0...38	0	√
位置值的 MSB 位号	1...39	12	√
硬件中断：更改方向 [1]	• 取消激活 • 激活	取消激活	√
硬件中断：发生了 DQ0 的比较事件 [1]	• 取消激活 • 激活	取消激活	√
硬件中断：发生了 DQ1 的比较事件 [1]	• 取消激活 • 激活	取消激活	√
硬件中断：零点 [1]	• 取消激活 • 激活	取消激活	√
硬件中断：新的 Capture 值可用 [1]	• 取消激活 • 激活	取消激活	√
设置输出	• 由用户程序使用 • 在比较值和上限之间 • 比较值和计数器下限之间 • 比较值 0 和 1 之间 • 不在比较值 0 和 1 之间 • 在比较值持续一个脉宽时间 • 在 CPU 发出置位命令后，达到比较值之前 • 无功能的数字量输出 [4]	DQ0、DQ1：在比较值和上限之间 （快速模式：无功能的数字量输出）	√

参数	值范围	默认设置	在 RUN 模式下重新组态
DQ 的替代值 [1]	• 0 • 1	DQ0、DQ1：0	√
DQ 功能 [1] 的 计数方向	• 向上 • 向下 • 两个方向均比较	两个方向均比较	√
脉冲宽度 [ms/10][1]	0...65535	5000 （对应于 0.5 s）	√
DI 的特性	• Capture • 无功能的数字量输入	DI0、DI1：无功能的数字量输入	√
为 DI[1] 选择边沿	• 在上升沿 • 下降沿 • 上升沿和下降沿	在上升沿	√
数字量输入 [1] 的输入延迟	• 无 • 0.05 ms • 0.1 ms • 0.4 ms • 0.8 ms • 1.6 ms • 3.2 ms • 12.8 ms • 20 ms	0.1 ms	√
比较值 0[1]	-2147483648...2147483647 （快速模式：0...33554431）	0	√
比较值 1[1]	-2147483648...2147483647 （快速模式：0...33554431）	10	√
测量变量	• 频率 • 周期 • 速度 • 完整 SSI 帧	频率	√

参数	值范围	默认设置	在 RUN 模式下重新组态
测量功能的更新时间 [µs] [1]	0...25000000	10000（对应于 10 ms）	√
速度测量的时间基数 [1]	• 1 ms • 10 ms • 100 ms • 1 s • 60 s/1 min	60 s/1 min	√
每单位增量数 [1]	1...65535	1	√
滞后 [1]	0...255	0	√
步进/转：[3]	1...65535	1	√
参考速度 [3] [10^{-2} rpm]	600...21000000	300000（对应于 3000 rpm）	√
电位组	• 使用左边模块（深色 BaseUnit）的电位组 • 启用新电位组（浅色 BaseUnit）	使用左边模块（深色 BaseUnit）的电位组	-

[1] 此参数不能通过 PROFIBUS GSD 文件进行组态。该参数随默认设置一起被下载至模块，并且可使用数据记录 128 进行调整。

[2] 使用 GSD 文件时，此诊断中断由“启用其它诊断中断”参数激活，且不能单独设置。

[3] 仅在“Motion Control 的定位输入”操作模式下可用

[4] 仅在“快速模式”操作模式下可用

4.5 控制和反馈接口

有关如何使用控制与反馈接口的信息，请参见组态 (页 35)一章。

有关 TM PosInput 1 控制和反馈位的详细说明，请参见“计数、测量和定位输入”功能手册，该手册可从 Internet (http://support.automation.siemens.com/WW/view/zh/59709820) 下载。

说明

该控制和反馈接口与 S7-1500 自动化系统的 TM PosInput 2 工艺模块的控制和反馈接口兼容。

说明

使用工艺对象操作

使用工艺对象时，控制和反馈接口由工艺对象进行操作。这意味着无需直接写入控制接口。

快速模式

控制接口在“快速模式”操作模式下不可用。反馈接口 (页 57)已在快速模式下进行了适应性分配。此外，可以查找有关反馈位的解释性说明 (页 57)。

4.5.1 控制接口的分配

用户程序使用控制接口来影响工艺模块的行为。

控制接口

下表显示了控制接口分配：

相对起始地址的偏移	参数	含义				
字节 0 到 3	Slot 0	加载值（在 LD_SLOT_0 中指定值的含义）				
字节 4 到 7	Slot 1	加载值（在 LD_SLOT_1 中指定值的含义）				
字节 8	LD_SLOT_0*	在 Slot 0 中指定值的含义				
		位 3	**位 2**	**位 1**	**位 0**	
		0	0	0	0	无操作、空闲
		0	0	0	1	装载计数值（适用于增量编码器或脉冲编码器）
		0	0	1	0	无效
		0	0	1	1	加载起始值（适用于增量编码器或脉冲编码器）
		0	1	0	0	加载比较值 0
		0	1	0	1	加载比较值 1
		0	1	1	0	加载计数下限（适用于增量编码器或脉冲编码器）
		0	1	1	1	加载计数上限（适用于增量编码器或脉冲编码器）
		1	0	0	0	无效
		到				
		1	1	1	1	

<table>
<tr><th>相对起始地址的偏移</th><th>参数</th><th colspan="5">含义</th></tr>
<tr><td rowspan="12"></td><td rowspan="12">LD_SLOT_1*</td><td colspan="5">在 Slot 1 中指定值的含义</td></tr>
<tr><td>位 7</td><td>位 6</td><td>位 5</td><td>位 4</td><td></td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>无操作、空闲</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>装载计数值（适用于增量编码器或脉冲编码器）</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>无效</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>加载起始值（适用于增量编码器或脉冲编码器）</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>加载比较值 0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>加载比较值 1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>加载计数下限（适用于增量编码器或脉冲编码器）</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>加载计数上限（适用于增量编码器或脉冲编码器）</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td rowspan="3">无效</td></tr>
<tr><td colspan="4">到</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>字节 9</td><td>EN_CAPTURE</td><td colspan="5">位 7：启用 Capture 功能</td></tr>
<tr><td></td><td>EN_SYNC_DN</td><td colspan="5">位 6：向下启用同步（适用于增量编码器或脉冲编码器）</td></tr>
<tr><td></td><td>EN_SYNC_UP</td><td colspan="5">位 5：向上启用同步（适用于增量编码器或脉冲编码器）</td></tr>
<tr><td></td><td>SET_DQ1</td><td colspan="5">位 4：设置 DQ1</td></tr>
<tr><td></td><td>SET_DQ0</td><td colspan="5">位 3：设置 DQ0</td></tr>
<tr><td></td><td>TM_CTRL_DQ1</td><td colspan="5">位 2：启用工艺功能 DQ1</td></tr>
<tr><td></td><td>TM_CTRL_DQ0</td><td colspan="5">位 1：启用工艺功能 DQ0</td></tr>
<tr><td></td><td>SW_GATE</td><td colspan="5">位 0：软件门（适用于增量编码器或脉冲编码器）</td></tr>
</table>

相对起始地址的偏移	参数	含义
字节 10	SET_DIR	位 7：计数方向（适用于无方向信号的编码器）
	–	位 2 到 6：保留；位必须设置为 0
	RES_EVENT	位 1：复位保存的事件
	RES_ERROR	位 0：复位保存的错误状态
字节 11	–	位 0 到 7：保留；位必须设置为 0

* 如果同时通过 LD_SLOT_0 和 LD_SLOT_1 装载值，则将从 Slot 0 内部获取第一个值，然后从 Slot 1 获取值。这可能会导致意外的中间状态。

4.5.2 反馈接口的分配

用户程序通过反馈接口从工艺模块中接收当前值和状态信息。

反馈接口

下表显示了反馈接口的分配：

相对起始地址的偏移	参数	含义
字节 0 到 3	COUNT_VALUE	DINT：当前计数器值或位置值
字节 4 到 7	CAPTURED_VALUE	DINT：最后采集的 Capture 值
字节 8 到 11	MEASURED_VALUE	REAL：当前测量值或 DWORD：完整 SSI 帧
字节 12	—	位 3 到 7：保留；设置为 0
	LD_ERROR	位 2：通过控制接口加载时出错
	ENC_ERROR	位 1：编码器信号或 SSI 帧错误
	POWER_ERROR	位 0：电源电压 L+ 过低
字节 13	—	位 6 到 7：保留；设置为 0
	STS_SW_GATE	位 5：软件门状态（适用于增量编码器或脉冲编码器）
	STS_READY	位 4：工艺模块已启动并组态
	LD_STS_SLOT_1	位 3：检测到 Slot 1 的加载请求并已执行（切换）
	LD_STS_SLOT_0	位 2：检测到 Slot 0 的加载请求并已执行（切换）
	RES_EVENT_ACK	位 1：事件复位位激活
	—	位 0：保留；设置为 0

相对起始地址的偏移	参数	含义
字节 14	—	位 7：保留；设置为 0
	STS_DI1	位 6：状态 DI1
	STS_DI0	位 5：状态 DI0
	STS_DQ1	位 4：状态 DQ1
	STS_DQ0	位 3：状态 DQ0
	STS_GATE	位 2：内部门状态（适用于增量编码器或脉冲编码器）
	STS_CNT	位 1：上一个大约 0.5 s 内检测到的计数脉冲或位置值变化
	STS_DIR	位 0：上一个计数器值或位置值变化的方向
字节 15	STS_M_INTERVAL	位 7：上一个测量间隔内检测到的计数脉冲或位置值变化
	EVENT_CAP	位 6：发生了 Capture 事件
	EVENT_SYNC	位 5：发生了同步（适用于增量编码器或脉冲编码器）
	EVENT_CMP1	位 4：发生了 DQ1 的比较事件
	EVENT_CMP0	位 3：发生了 DQ0 的比较事件
	EVENT_OFLW	位 2：发生了上溢
	EVENT_UFLW	位 1：发生了下溢
	EVENT_ZERO	位 0：发生了过零点

4.5.3 在快速模式下分配反馈接口

用户程序通过反馈接口从工艺模块中接收当前值和状态信息。

反馈接口

下表所示为快速模式下的反馈接口分配：

相对起始地址的偏移	参数	含义
字节 0 到 3	LS	位 31：在等时同步模式下：生命期标记（切换）；非等时模式：设为 0
	STS_READY	位 30：工艺模块已启动并组态
	—	位 29：保留；设置为 0
	EXT_F	位 28：组错误
	STS_DI0	位 27：状态 DI0
	STS_DIR	位 26：上一个计数器值或位置值变化的方向
	STS_DI1	位 25：状态 DI1
	COUNT_VALUE	位 0 到 24：当前计数器值或位置值

有关反馈位的说明

反馈位	备注
COUNT_VALUE	该值在 DINT 值的第一个 25 位处返回当前计数值或位置值。
EXT_F	此位指示工艺模块的编码器信号发生下列错误之一： • 电源电压错误 • A/B 信号的转换非法（采用增量编码器） • RS422/TTL 错误 • SSI 编码器错误或 SSI 帧错误（适用于 SSI 绝对编码器） 如果已启用诊断中断，则在编码器信号发生错误时会触发相应的诊断中断。有关诊断中断含义的信息，请参见诊断消息 (页 67)部分。 该位在错误消失后立即自动复位。
LS	在等时同步模式下，该位将状态变化（切换）作为生命期标记，通过该标记指示相应应用程序周期中已检测到新计数值或位置值。 在非等时同步模式中，该位置 0。
STS_DI0	该位指示数字量输入 DI0 的状态。
STS_DI1	该位指示数字量输入 DI1 的状态。
STS_DIR	该位指示上一个计数脉冲的计数方向或上一个位置值变化的方向。 0 表示：向下 1 表示：向上
STS_READY	该位表示工艺模块提供有效的用户数据。工艺模块已启动并组态。

中断/诊断消息

5

5.1 状态和错误指示灯

LED

下图显示了 TM PosInput 1 的 LED 指示灯（状态和错误指示灯）。

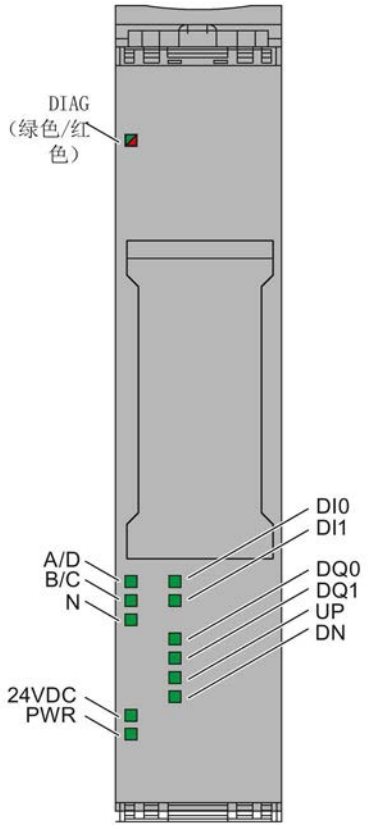


图 5-1 TM PosInput 1 的 LED

LED 指示灯的含义

下表说明了状态和错误指示灯的含义。 有关诊断报警的修正措施的相关信息，请参见诊断消息 (页 67)小节。

表格 5- 1　状态和错误指示灯 DIAG

LED DIAG	含义	要纠正或避免错误
▫ 灭	ET 200SP 的背板总线电源不正常	检查电源电压或接通接口模块上的电源电压。
☼ 闪烁	工艺模块未组态	---
■ 亮	工艺模块已组态，但未诊断模块	
☼ 闪烁	工艺模块已组态并且已诊断模块（至少有一个错误未决）	判断诊断报警并消除错误。

表格 5- 2　PWR/24VDC 状态显示

LEDs		含义	要纠正或避免错误
PWR	24VDC		
▫ 灭	▫ 灭	无电源电压	• 检查电源电压。 • 检查 BaseUnit 类型和 BaseUnit 接线。
■ 亮	■ 亮	电源电压存在且状态良好	---
■ 亮	▫ 灭	编码器电源短路或过载或者电源电压过低	• 检查编码器接线。 • 检查连接到编码器电源的负载。 • 检查电源电压。

通道 LED

LED A、B、N 和 DIm 指示关联信号的当前电平。数字量输出 DQm 的 LED 指示期望的状态。

通道 LED 的闪烁频率限制为约 12 Hz。 如果存在更高的频率，通道 LED 将以 12 Hz 的频率闪烁，而不指示当前状态。

如果使用的是 SSI 绝对编码器，则在传输编码器帧期间，LED D 和 C 将点亮为绿色。 发生错误时，LED D 和 C 均熄灭。

表格 5- 3　A/B/N/DIm/DQm 状态显示

A/B/N/DIm/DQm LED	含义
□ 灭	计数器输入/数字量输入/数字量输出处于 0 电平
■ 亮	计数器输入/数字量输入/数字量输出处于 1 电平

表格 5- 4　状态指示灯 UP/DN

LED		含义
UP	DN	
□ 灭	□ 灭	最后 0.5 s 内未检测到计数脉冲。
■ 亮	□ 灭	上个计数脉冲已经使计数器增大，并且是在不超过 0.5 s 的时间内完成的。
□ 灭	■ 亮	上个计数脉冲已经使计数器减小，并且是在不超过 0.5 s 的时间内完成的。

5.2 参数检验错误

如在 STEP 7 (TIA Portal) 或 STEP 7 中进行参数设置，参数值会在其传送至工艺模块前进行检查。该过程可防止发生参数错误。

在其它用例中，工艺模块检查已传送参数的数据记录。如果工艺模块存在无效或不一致的参数值，会输出错误代码（请参见下文）。在这种情况下，新的参数数据记录将被拒绝，当前参数值将在传送有效参数数据记录前继续使用。

WRREC

如果 CPU 处于 RUN 模式，可使用 WRREC（写入记录）指令更改参数数据记录。

示例：

假设使用 WRREC 指令将一个无效值（例如 9）写入操作模式的模块。结果是该模块拒绝所有参数数据记录。可通过评估 WRREC 指令的 STATUS 输出参数识别该情况。STATUS 输出参数作为值为 16#DF80E111 的 BYTE 数据的 ARRAY[1..4] 输出：

WRREC STATUS 数据示例	地址	含义
DF_H	STATUS[1]	通过 PROFINET IO (IEC 61158-6) 写入数据记录时出错
80_H	STATUS[2]	通过 PROFINET IO (IEC 61158-6) 读取或写入数据记录时出错
$E1_H$	STATUS[3]	特定模块错误
11_H	STATUS[4]	错误代码请参见下表： “操作模式”存在无效值。

错误代码

如果正在使用增量编码器或脉冲编码器，则在参数数据记录传送至模块后，WRREC 可能包含下列错误代码：

错误代码	参数	检验标准
11_H	操作模式	无效值
12_H	针对 CPU 停止状态的响应	无效值
13_H	信号类型	无效值
15_H	计数器输入的滤波器频率	无效值
16_H	针对信号 N 的响应	无效值
17_H	设置 DI 的功能	无效值
18_H	• 设置 DI (DI0) 的功能 • 设置 DI (DI1) 的功能	为 DI0 和 DI1 组态相同功能
19_H	• 设置 DI (DIm) 的功能 • 边沿选择 (DIm)	• 无效值 • 将“门启动（受控边沿）”组态为 DIm 和“上升沿和下降沿”的功能 • 将“门停止（受控边沿）”组态为 DIm 和“上升沿和下降沿”的功能 • 将“同步”组态为 DIm 和“上升沿和下降沿”的功能
$1A_H$	数字量输入的输入延迟	无效值
$1B_H$	设置输出	无效值
$1C_H$	DQ 功能的计数方向	无效值
$1D_H$	在超出计数限值时复位	无效值
$1E_H$	针对超出计数限值的响应	无效值
20_H	针对门启动的响应	无效值
21_H[1]	• 计数器下限 • 比较值 0 • 比较值 1	计数器下限 > 比较值 0/1
22_H[1]	• 计数器上限 • 比较值 0 • 比较值 1	计数器上限 < 比较值 0/1
23_H	• 计数器下限 • 起始值	起始值 < 计数器下限
24_H	• 计数器上限 • 起始值	起始值 > 计数器上限
25_H	更新时间	大于最大值

错误代码	参数	检验标准
26_H[2]	参考速度	• 小于最小值 • 大于最大值
27_H	测量变量	无效值
28_H	速度测量的时间基数	无效值
29_H	每单位增量数	无效值
$2A_H$	• 计数器下限 • 计数器上限	计数器下限 >= 计数器上限
$2B_H$	• 比较值 0 • 比较值 1	比较值 0 >= 比较值 1
$2C_H$	信号评估	无效值
$2D_H$	设置输出	• 为 DQ0 组态“比较值 0 和 1 之间” • 为 DQ0 组态“未在比较值 0 和 1 之间” • 为 DQ1 组态“比较值 0 和 1 之间”，但不为 DQ0 组态“由用户程序使用”。 • 为 DQ1 组态“未在比较值 0 和 1 之间”，但不为 DQ0 组态“由用户程序使用”。
$2E_H$	• 设置 DI 的功能 • 操作模式	在“测量”操作模式下组态 "Capture"
$3A_H$[3]	同步计数方向	无效值

1 仅用于“计数”操作模式

2 仅用于“Motion Control 的定位输入”操作模式

3 仅用于“快速模式”操作模式

如果正在使用 SSI 绝对编码器，则在参数数据记录传送至模块后，WRREC 可能包含下列错误代码：

错误代码	参数	检验标准
11_H	操作模式	无效值
12_H	针对 CPU 停止状态的响应	无效值
13_H	信号类型	无效值
18_H	• 设置 DI (DI0) 的功能 • 设置 DI (DI1) 的功能	为 DI0 和 DI1 组态相同功能
19_H	• 设置 DI (DIm) 的功能 • 边沿选择 (DIm)	• 无效值 • 将“门启动（受控边沿）”组态为 DIm 和“上升沿和下降沿”的功能 • 将“门停止（受控边沿）”组态为 DIm 和“上升沿和下降沿”的功能 • 将“同步”组态为 DIm 和“上升沿和下降沿”的功能
$1A_H$	数字量输入的输入延迟	无效值
$1B_H$	设置输出	无效值
$1C_H$	DQ 功能的计数方向	无效值
21_H[1]	• 计数器下限 • 比较值 0 • 比较值 1	计数器下限 > 比较值 0/1
22_H[1]	• 计数器上限 • 比较值 0 • 比较值 1	计数器上限 < 比较值 0/1
25_H	更新时间	大于最大值
26_H[2]	参考速度	• 小于最小值 • 大于最大值
27_H	测量变量	无效值
28_H	速度测量的时间基数	无效值
29_H	每单位增量数	无效值

错误代码	参数	检验标准
$2B_H$	• 比较值 0 • 比较值 1	比较值 0 >= 比较值 1
$2D_H$	设置输出	• 为 DQ0 组态“比较值 0 和 1 之间” • 为 DQ0 组态“未在比较值 0 和 1 之间” • 为 DQ1 组态“比较值 0 和 1 之间”，但不为 DQ0 组态“由用户程序使用”。 • 为 DQ1 组态“未在比较值 0 和 1 之间”，但不为 DQ0 组态“由用户程序使用”。
$2E_H$	• 设置 DI 的功能 • 操作模式	在“测量”操作模式下组态 "Capture"
$2F_H$	设置 DI 的功能	无效值
30_H	单稳态触发器时间	无效值
31_H	传输速率	无效值
32_H	奇偶校验	无效值
33_H	帧长度	无效值
34_H	• 位置值的 LSB 位号 • 位置值的 MSB 位号 • 帧长度	• 位置值的 LSB 位号 < 0 • 位置值的 LSB 位号 > 位置值的 MSB 位号 • 位置值的 MSB 位号 - 位置值的 LSB 位号 >= 31 • 位置值的 MSB 位号 > 帧长度
35_H	脉冲持续时间	小于最小值

1 只用于“计数/定位输入”操作模式

2 仅用于“Motion Control 的定位输入”操作模式

5.3 诊断消息

诊断报警

如果诊断报警未决，DIAG LED 将以红色闪烁。

STEP 7 (TIA Portal) 在线和诊断视图中的诊断以纯文本形式呈现。可通过用户程序评估错误代码。

可能指示以下诊断信息：

表格 5- 5 诊断报警、含义以及补救措施

诊断报警	错误代码	含义	要纠正或避免错误
错误	9_H	• 出现内部模块错误 • 可能原因：工艺模块有故障	更换工艺模块
参数分配错误	10_H	• 接收的参数数据记录无效 • 组态的 BaseUnit 不是使用的 BaseUnit	• 检查参数数据记录 • 检查 BaseUnit
无负载电压	11_H	• 无工艺模块 L+ 电源电压 • 可能的原因：BaseUnit 类型错误	• 检查 BaseUnit 类型 • 检查 BaseUnit 上的电源电压 L+ 的接线
硬件中断丢失	16_H	• 由于尚未处理前一中断，因此工艺模块无法发送中断 • 可能原因： – 参数分配错误 – 短时间内出现过多硬件中断事件	• 更改 CPU 中的中断处理并相应地重新分配工艺模块参数 • 检查过程中断频率
模块暂时不可用	$1F_H$	• 工艺模块不能正常运行 • 可能原因：工艺模块正在进行固件更新	• 请等待至工艺模块再次可用 • 如果固件更新中止： – 检查所需的最小固件版本 – 检查电源电压 – 重复固件更新
内部错误	100_H	工艺模块有故障	更换工艺模块

诊断报警	错误代码	含义	要纠正或避免错误
看门狗跳闸。模块发生故障。	103_H	固件出错	运行固件更新
		工艺模块有故障	更换工艺模块
外部编码器电源短路或过载	$10E_H$	• 编码器电源出现故障 • 可能原因： – 短路 – 过载	• 检查编码器接线 • 检查连接到编码器电源的用户
数字量输出出错	$10F_H$	• 数字量输出出错 • 可能原因： – 短路 – 过载	• 检查数字量输出的接线 • 检查连接到数字量输出的用户
电源电压错误	110_H	• 电源电压 L+ 错误 • 可能原因： – 电压低 – L+ 电源电压的接线错误	• 检查 L+ 电源电压 • 检查 BaseUnit 上的电源电压 L+ 的接线 • 检查负载组的总功耗
A/B 信号比率非法	500_H	• 增量编码器信号 A 和 B 的时间曲线不符合某些规范 • 可能原因： – 信号频率过高 – 编码器发生故障 – 过程接线发生故障	• 检查过程接线 • 检查编码器/传感器 • 检查参数分配

诊断报警	错误代码	含义	要纠正或避免错误
RS422/TTL 错误	502H	• 错误发生在连接 RS 422、TTL 编码器或 SSI 绝对编码器的过程中 • 可能原因： – 断线 – 未连接编码器 – 电缆过长 – 短路 – 过载 – 外部电压 – 过热 – 参数分配错误	• 检查过程接线 • 检查编码器/传感器 • 检查参数分配
SSI 编码器错误	503H	• SSI 绝对编码器连接错误 • 可能原因： – 断线 – 电缆过长 – 帧错误（起始位或停止位错误） – 奇偶校验错误 – 参数分配错误	• 检查过程接线 • 检查 SSI 绝对编码器 • 检查参数分配
过热	506H	• 模块温度过高 • 可能原因： – 数字量输出或编码器电源的输出发生短路或过载 – 环境温度超出规范 – 模块中的污染物阻碍冷却	• 检查过程接线 • 改善冷却效果 • 检查连接的负载

5.4 中断

5.4.1 触发诊断中断

启用诊断中断

设备组态期间，可以在基本参数中启用有关断线情况的诊断中断和其它错误的诊断中断。

可触发诊断中断的所有错误的列表在触发诊断中断的错误的原因 (页 71)中提供。

对诊断中断的响应

如果发生触发诊断中断的事件，则会发生以下情况：

- DIAG LED 以红色闪烁。

  消除错误后，DIAG LED 就会熄灭。

- S7-1500 CPU 中断对用户程序的处理。 调用诊断中断 OB（例如 OB 82）。 触发了中断的事件将输入到诊断中断 OB 的启动信息中。

- S7-1500 CPU 保持 RUN 模式，即使 CPU 中不存在诊断中断 OB 也是如此。 只要有可能，工艺模块就会继续工作，无论是否存在错误。

有关错误事件的详细信息，可以使用指令“RALRM”进行获取（读取更多中断信息）。

默认设置

默认情况下不启用有关断线情况的诊断中断和其它错误的诊断中断。

5.4.2 触发诊断中断的错误的原因

哪些错误会触发诊断中断？

工艺模块可触发以下诊断中断：

表格 5- 6 可能的诊断中断

诊断中断	监视
• 错误 • 参数分配错误 • 模块暂时不可用 • 内部错误 • 看门狗跳闸。模块发生故障。	监视总是处于激活状态。每次检测到错误时都触发诊断中断。
• RS422/TTL 错误	监视总是处于激活状态。只有在设备组态中启用“启用断线诊断中断”后，检测到的错误才会触发诊断中断。
• 无负载电压 • 硬件中断丢失 [1] • 外部编码器电源短路或过载 • 数字量输出出错 • 电源电压错误 • SSI 编码器错误 • A/B 信号比率非法 • 过热	监视总是处于激活状态。只有在设备组态中启用“启用附加诊断中断”后，检测到的错误才会触发诊断中断。

[1] 在“运动控制的定位输入”和“快速模式”下不可用

5.4.3 触发硬件中断

简介

对于工艺模块，可以组态运行期间哪些事件将触发硬件中断。

什么是硬件中断？

工艺模块将根据组态触发硬件中断来响应特定事件/状态。发生硬件中断时，CPU 将中断用户程序并处理分配的硬件中断 OB。触发了中断的事件将由 CPU 输入分配的硬件中断 OB 的启动信息中。

激活硬件中断

可在下列操作模式下使用硬件中断：

- 使用工艺对象操作
- 手动模式

在工艺模块的设备组态期间，在 STEP 7 (TIA Portal) 中的“基本参数 > 硬件中断”下激活硬件中断。

各硬件中断的列表在可触发硬件中断的事件 (页 73)中提供。

丢失硬件中断

如果发生应触发硬件中断的事件，但前面的相同事件尚未得到处理，则将不触发其它硬件中断。该硬件中断丢失。这可能会导致“硬件中断丢失”诊断发生中断，具体取决于参数分配。

默认设置

默认设置下未激活任何硬件中断。

5.4.4 可触发硬件中断的事件

哪些事件可触发硬件中断？

如果满足反馈接口中对应状态位或事件位变化的条件，则触发硬件中断。

其中，EventType 变量将在触发硬件中断时输入到所分配硬件中断 OB 的启动信息中。EventType 变量指定触发中断的事件所属事件类型的编号。

可以组态针对以下事件类型触发的硬件中断：

硬件中断	EventType 编号
内部门打开（门启动）1)	1
内部门关闭（门停止）1)	2
上溢（超出计数上限）1)	3
下溢（超出计数下限）1)	4
发生了 DQ0 的比较事件	5
发生了 DQ1 的比较事件	6
过零点	7
新的 Capture 值可用 2)	8
通过外部信号同步计数器 1)	9
更改方向 3)	10

1) 不适用于 SSI 绝对编码器

2) 只能在计数模式下组态

3) 反馈位 STS_DIR 的默认值为“0”。 如果第一个计数器值或位置值在开启工艺模块后立即以*向下方向*变化，则不会触发硬件中断。

可通过激活任意组合的事件来触发硬件中断。

技术规范

6

	6ES7138-6BA00-0BA0
常规信息	
产品型号名称	TM PosInput 1
可以使用的 BaseUnit	A0 类型的 BU
产品功能	
I&M 数据	√；I&M0 到 I&M3
工程组态方式	
TIA Portal 中 STEP 7 可组态的版本/可集成的版本（或更高版本）	V13/V13
STEP 7 可组态的版本/可集成的版本（或更高版本）	V5.5 SP3/V5.5 SP4
PROFIBUS GSD 文件版本/GSD 文件修订版及更高版本	GSD 修订版 5
PROFIBUS GSD 文件版本/GSD 文件修订版及更高版本	GSDML V2.3
安装类型/安装	
可采用机架安装	支持
可采用导轨安装	支持
电源电压	
负载电压 L+	
额定值（直流）	24 V
有效范围（直流）的下限	19.2 V
有效范围（直流）的上限	28.8 V
反极性保护	√
输入电流	
最大电流损耗	75 mA；无负载

	6ES7138-6BA00-0BA0
编码器电源	
输出数量	1
24 V 编码器电源	
24 V	√；L+ (-0.8 V)
短路保护	√
最大输出电流	300 mA
功耗	
典型功耗	1.9 W
地址区	
已占用地址区	
输入	16 个字节；4 个字节用于快速模式
输出	12 个字节；4 个字节用于运动控制；无字节用于快速模式
数字输入	
输入数量	2
数字量输入，可组态	√
输入特性符合 IEC 61131，类型 3	√
数字量输入功能，可组态	
门启动/停止	√；仅限脉冲和增量编码器
捕获	支持；快速模式下不可用
同步	√；仅限脉冲和增量编码器
可随意分配的数字量输入	√
输入电压	
直流额定值	24 V
信号为“0”时	-30 ... +5 V
信号为“1”时	+11 ... +30 V
输入上允许的最小电压	-30 V
输入上允许的最大电压	30 V

	6ES7138-6BA00-0BA0
输入电流	
信号为“1”时的典型值	2.5 mA
输入延时（在输入额定电压时）	
标准输入	
• 可组态	有；无 / 0.05 / 0.1 / 0.4 / 0.8 / 1.6 / 3.2 / 12.8 / 20 ms
• “0”到“1”时的最小值	6 µs；参数分配为“无”
• “1”到“0”时的最小值	6 µs；参数分配为“无”
对于计数器/工艺功能	
• 可组态	√
电缆长度	
最大屏蔽电缆长度	1000 m
最大非屏蔽电缆长度	600 m
数字输出	
数字量输出的类型	晶体管
输出数量	2
数字量输出，可组态	√
短路保护	√；电子/热
• 典型响应阈值	1 A
电感关断电压的限制	L+ (-33 V)
数字量输入的控制	√
数字量输出功能，可组态	
在比较值处切换	√
可随意分配的数字量输出	支持；快速模式下不可用
输出切换容量	
最大阻性负载	0.5 A；每个数字量输出
最大灯负载	5 W

	6ES7138-6BA00-0BA0
负载电阻范围	
下限	48 Ω
上限	12 kΩ
输出电压	
信号为“1”时的最小值	23.2 V；L+ (-0.8 V)
输出电流	
信号为“1”时的额定电流	0.5 A；每个数字量输出
信号为“1”时的最大允许范围	0.6 A；每个数字量输出
信号为“1”时的最小负载电流	2 mA
信号为“0”时残余电流的最大值	0.5 mA
输出延时，有阻性负载	
“0”到“1”时的最大值	50 µs
“1”到“0”时的最大值	50 µs
切换频率	
最大阻性负载	10 kHz
最大感性负载	0.5 Hz；符合 IEC 60947-5-1，DC-13；遵守降额曲线
最大灯负载	10 Hz
输出的总电流	
每个模块的最大电流	1 A
电缆长度	
最大屏蔽电缆长度	1000 m
最大非屏蔽电缆长度	600 m

	6ES7138-6BA00-0BA0
编码器	
编码器信号，增量编码器（对称）	
输入电压	RS 422
最大输入频率	1 MHz
最大计数频率	4 MHz；具有四重评估
信号滤波器，可组态	√
屏蔽电缆的最大长度	32 m；1 MHz
具有 A/B 轨迹（相移 90°）的增量编码器	√
具有 A/B 轨迹（相移 90°）和零轨迹的增量编码器	√
脉冲编码器	√
带有方向的脉冲编码器	√
每个计数方向有一个脉冲信号的脉冲编码器	√
编码器信号，增量编码器（非对称）	
输入电压	5 V TTL（仅限推挽式编码器）
最大输入频率	1 MHz
最大计数频率	4 MHz；具有四重评估
信号滤波器，可组态	√
具有 A/B 轨迹（相移 90°）的增量编码器	√
具有 A/B 轨迹（相移 90°）和零轨迹的增量编码器	√
脉冲编码器	√
带有方向的脉冲编码器	√
每个计数方向有一个脉冲信号的脉冲编码器	√

	6ES7138-6BA00-0BA0
编码器信号，绝对编码器 (SSI)	
输入信号	到 RS 422
帧长度，可组态	10 ... 40 位
最大时钟频率	2 MHz；125 kHz、250 kHz、500 kHz、1 MHz、1.5 MHz 或 2 MHz
二进制代码	√
格雷码	√
屏蔽电缆的最大长度	320 m；电缆长度，RS-422 SSI 绝对编码器，Siemens 型号 6FX2001-5，24 V 电源：125 kHz，最长 320 米，带屏蔽；250 kHz，最长 160 米，带屏蔽；500 kHz，最长 60 米，带屏蔽；1 MHz，最长 20 米，带屏蔽；1.5 MHz，最长 10 米，带屏蔽；2 MHz，最长 8 米，带屏蔽
奇偶校验位，可组态	√
单稳态触发器时间	16、32、48、64 µs 和自动
多匝	√
单匝	√
接口硬件	
RS 422	√
TTL 5 V	√；仅限推挽式编码器
等时模式	
等时模式（应用程序同步至终端）	√

	6ES7138-6BA00-0BA0
中断/诊断/状态信息	
激活替代值	√；可组态
中断	
诊断中断	√
硬件中断	支持；快速模式下不可用
诊断消息	
电源监视	√
断线	√
短路	√
增量编码器 A/B 切换错误	√
SSI 编码器帧错误	√
组错误	√
LED 诊断显示	
电源电压监视（电源 LED）	√，绿色 PWR LED 指示灯
模块诊断	√；绿色/红色 DIAG LED 指示灯
向下计数状态显示（绿色）	√
向上计数状态显示（绿色）	√
集成的功能	
计数器数量	1
最大计数频率（计数器）	4 MHz；具有四重评估

	6ES7138-6BA00-0BA0
计数功能	
可与 TO High_Speed_Counter 配合使用	√；仅限脉冲和增量编码器
连续计数	√
计数器响应可组态	√
基于数字量输入的硬件门	√
软件门	支持；快速模式下不可用
事件触发的停止	√
基于数字量输入的同步	√
计数范围，可组态	√
比较器	
• 比较器数量	2
• 方向相关	√
• 可通过用户程序更改	√
位置检测	
增量检测	√
绝对检测	√
适用于 S7-1500 运动控制	√
测量功能	
测量时间，可组态	√
动态测量时间调整	√
阈值数量，可组态	2
测量范围	
• 最小频率测量	0.04 Hz
• 最大频率测量	4 MHz
• 最小周期测量	0.25 µs
• 最大周期测量	25 s
精度	
• 频率测量	100 ppm；取决于测量间隔和信号评估
• 周期测量	100 ppm；取决于测量间隔和信号评估
• 速度测量	100 ppm；取决于测量间隔和信号评估

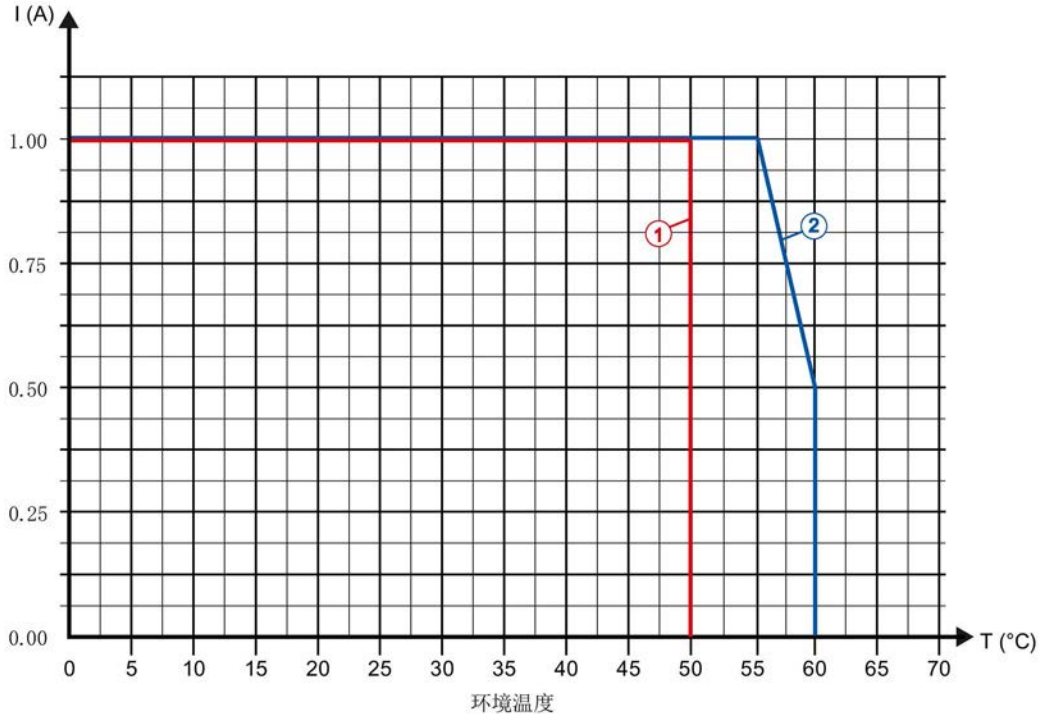
	6ES7138-6BA00-0BA0
电气隔离	
电气隔离通道	
通道和背板总线之间	√
允许的电位差	
不同电路之间	75 V DC/60 V AC（基本绝缘）
绝缘	
绝缘测试电压	707 V DC（型式测试）
环境条件	
运行环境温度	
水平安装时的最低温度	0 °C
水平安装时的最高温度	60 ℃；注意降额
垂直安装时的最低温度	0 °C
垂直安装时的最高温度	50 ℃；注意降额
尺寸	
宽度	15 mm
重量	
近似重量	45 g

输出总电流的降额信息

如果 TM PosInput 1 的数字量输出与阻性或感性负载配合使用，应对工艺模块数字量输出上的负载进行总电流降额。总电流是一个模块的所有数字量输出（不包括编码器电源）的负载电流总和。

以下降额曲线以如下条件为基准显示了数字量输出的负载能力与环境温度和安装位置之间的关系：

- 负载电阻：48 Ω (IEC 947-5-1)

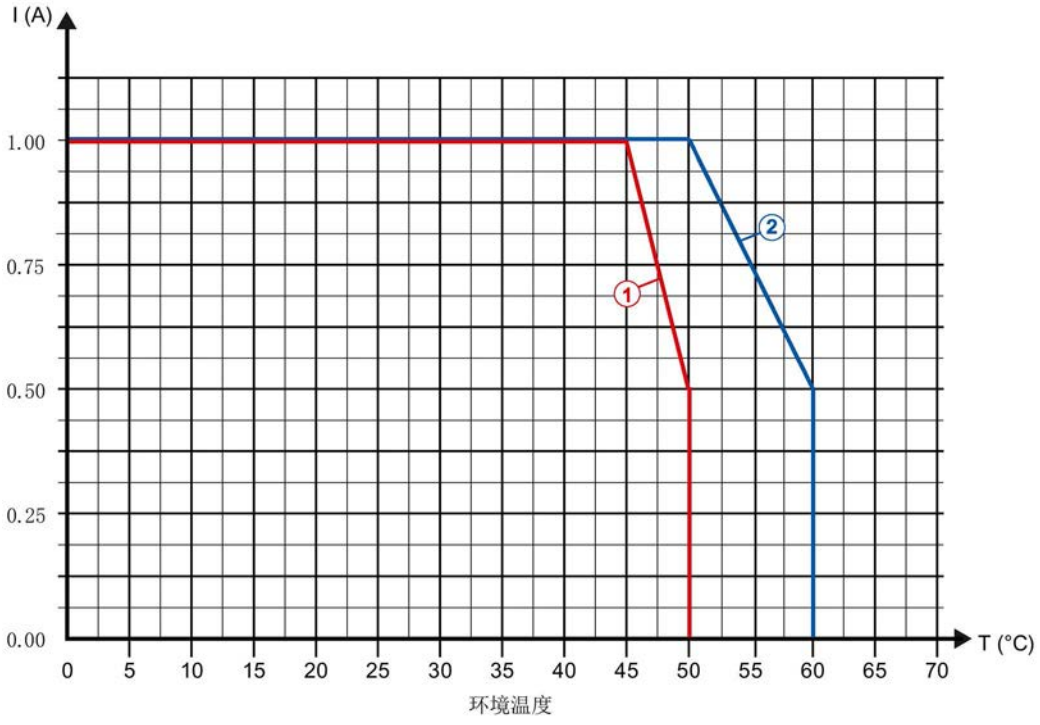


① 垂直安装系统
① 水平安装系统

图 6-1 取决于环境温度和安装位置的阻性负载总电流

以下降额曲线以如下条件为基准显示了数字量输出的负载能力与环境温度和安装位置之间的关系：

- 数字量输出的最大切换频率为 0.5 Hz
- 负载电阻：48 Ω (IEC 947-5-1)
- 负载电感：1150 mH (IEC 947-5-1)



① 垂直安装系统
① 水平安装系统

图 6-2 基于环境温度和安装位置的感性负载的总电流

说明

如果切换频率大于 0.5 Hz 或数字量输出的感性负载大于上述值，则必须进一步减少总电流。

尺寸图

请参见“ET 200SP BaseUnit (http://support.automation.siemens.com/WW/view/zh/58532597/133300)”手册

参数数据记录

A

如果 CPU 处于 RUN 模式，可通过用户程序更改模块的参数分配。可使用数据记录 128（例如通过 WRREC 指令）将这些参数传送至模块。

如果在使用 WRREC 指令传送或验证参数期间发生错误，模块将使用之前的参数分配继续操作。相应的错误代码随后将写入 STATUS 输出参数。如果未发生错误，STATUS 输出参数将包含实际传送数据的长度。

有关 WRREC 指令的说明和错误代码，请参见参数检验错误 (页 62)部分或 STEP 7 (TIA Portal) 的在线帮助。

用于使用工艺对象操作和手动模式的数据记录 128 结构

下表所示为用于操作模式“使用工艺对象操作”和“手动模式”的 TM PosInput 1 数据记录 128 结构。字节 0 到字节 3 中的值是固定的且不可更改。只能在 CPU 未处于 RUN 模式时通过分配新参数的方式来更改字节 4 中的值。

表格 A- 1　参数数据记录 128：操作模式“使用工艺对象操作”和“手动模式”

位 → / 字节 ↓	位 7	位 6	位 5	位 4	位 3	位 2	位 1	位 0
0...3	**标头**							
0	Major Version = 0				Minor Version = 1			
1	每个通道的参数数据的长度 = 48							
2	预留 2)							
3	预留 2)							
4	**工作模式**							
4	预留 2)				工作模式：			
					0000_B：无效			
					0001_B：计数/定位输入			
					0010_B：测量			
					0011 至 1111_B：无效			

位 → / 字节 ↓	位 7	位 6	位 5	位 4	位 3	位 2	位 1	位 0
5	**基本参数**							
5	接口标准： 0_B：RS422，对称 1_B：TTL (5 V)，非对称	预留 2)				启用附加诊断中断 1)	对 CPU STOP 模式的响应： 00_B：输出替换值 01_B：保持上一个值 10_B：继续工作 11_B：无效	

位 → 字节 ↓	位 7	位 6	位 5	位 4	位 3	位 2	位 1	位 0
6...7	**计数器输入**（适用于增量编码器和脉冲编码器的参数）							
6	预留 2)		信号评估：		信号类型：			
			00_B：单重		0000_B：脉冲 (A)			
			01_B：双重		0001_B：脉冲 (A) 和方向 (B)			
			10_B：四重		0010_B：向上计数 (A)，向下计数 (B)			
			11_B：无效		0011_B：增量编码器（A、B 相移）			
					0100_B：增量编码器（A、B、N）			
					0101_B：绝对编码器 (SSI)			
					0110 到 1111_B：无效			
7	对信号 N 的响应：		反转方向 1)	启用断线诊断中断 1)	滤波频率 4)：			
	00_B：对信号 N 无响应				0000_B：100 Hz			
	01_B：在信号 N 处同步				0001_B：200 Hz			
	10_B：在信号 N 处捕获				0010_B：500 Hz			
	11_B：无效				0011_B：1 kHz			
					0100_B：2 kHz			
					0101_B：5 kHz			
					0110_B：10 kHz			
					0111_B：20 kHz			
					1000_B：50 kHz			
					1001_B：100 kHz			
					1010_B：200 kHz			
					1011_B：500 kHz			
					1100_B： 1 MHz			
					1101 到 1111_B：无效			

位 → 字节 ↓	位 7	位 6	位 5	位 4	位 3	位 2	位 1	位 0
6...7	**计数器输入**（适用于 SSI 绝对编码器的参数）							
6	单稳态触发器时间 4)：			代码类型：	信号类型：			
	000_B：自动			0_B：格雷码	0000_B：脉冲 (A)			
	001_B：16 µs			1_B：二进制码	0001_B：脉冲 (A) 和方向 (B)			
	010_B：32 µs				0010_B：向上计数 (A)，向下计数 (B)			
	011_B：48 µs				0011_B：增量编码器（A、B 相移）			
	100_B：64 µs				0100_B：增量编码器（A、B、N）			
	101 到 111_B：无效				0101_B：绝对编码器 (SSI)			
					0110 到 1111_B：无效			
7	奇偶校验 4)：		反转方向 1)	启用断线诊断中断 1)	预留 2)	传输速率 4)：		
	00_B：无					000_B：125 kHz		
	01_B：偶校验					001_B：250 kHz		
	10_B：奇校验					010_B：500 kHz		
	11_B：无效					011_B：1 MHz		
						100_B：1.5 MHz		
						101_B：2 MHz		
						110 到 111_B：无效		
8...9	**硬件中断** 1)							
8	预留 2)	预留 2)	预留 2)	更改方向	下溢（超出计数下限）	上溢（超出计数上限）	门停止 3)	门启动 3)
9	通过外部信号同步计数器 3)	新捕获值可用	预留 2)	过零点	预留 2)	发生了 DQ1 的比较事件	预留 2)	发生了 DQ0 的比较事件

位 → 字节 ↓	位 7	位 6	位 5	位 4	位 3	位 2	位 1	位 0
10...15	DQ 的特性							
10	设置输出 (DQ1)：				设置输出 (DQ0)：			
	0000_B：由用户程序使用				0000_B：由用户程序使用			
	0001_B：在比较值和计数器上限之间；测量：测量值 >= 比较值				0001_B：在比较值和计数器上限之间；测量：测量值 >= 比较值			
	0010_B：在比较值和计数器下限之间；测量：测量值 <= 比较值				0010_B：在比较值和计数器下限之间；测量：测量值 <= 比较值			
	0011_B：在比较值持续一个脉宽时间				0011_B：在比较值持续一个脉宽时间			
	0100_B：比较值 0 和 1 之间				0100_B：无效			
	0101_B：在 CPU 发出置位命令后，达到比较值之前				0101_B：在 CPU 发出置位命令后，达到比较值之前			
	0110_B：不在比较值 0 和 1 之间				0110 到 1111_B：无效			
	0111 到 1111_B：无效							
11	计数方向 (DQ1)：		计数方向 (DQ0)：		预留 2)	预留 2)	DQ1 的替代值	DQ0 的替代值
	00_B：无效		00_B：无效					
	01_B：正向		01_B：正向					
	10_B：反向		10_B：反向					
	11_B：两个方向均比较		11_B：两个方向均比较					
12	脉冲持续时间 (DQ0)：							
13	UINT：取值范围（以 ms/10 为单位）：0 到 65535_D							
14	脉冲持续时间 (DQ1)：							
15	UINT：取值范围（以 ms/10 为单位）：0 到 65535_D							

<table>
<tr><td>位 →
字节 ↓</td><td>位 7</td><td>位 6</td><td>位 5</td><td>位 4</td><td>位 3</td><td>位 2</td><td>位 1</td><td>位 0</td></tr>
<tr><td>16</td><td colspan="8">DI0 的特性</td></tr>
<tr><td rowspan="8">16</td><td rowspan="4">Capture 后的计数器值特性 3) (DI0)：</td><td colspan="2">沿选择 (DI0)：</td><td rowspan="2">选择电平 (DI0)：</td><td rowspan="8">预留 2)</td><td colspan="3">设置 DI 的功能(DI0)：</td></tr>
<tr><td colspan="2">00_B：无效</td><td colspan="3">000_B：门启动/停止（电平触发）3)</td></tr>
<tr><td colspan="2">01_B：在上升沿</td><td rowspan="2">0_B：高电平激活</td><td colspan="3">001_B：门启动（沿触发）3)</td></tr>
<tr><td colspan="2">10_B：下降沿</td><td colspan="3">010_B：门停止（边沿触发）3)</td></tr>
<tr><td rowspan="2">0_B：继续计数</td><td colspan="2" rowspan="2">11_B：上升沿和下降沿</td><td rowspan="2">1_B：低电平激活</td><td colspan="3">011_B：同步 3)</td></tr>
<tr><td colspan="3">100_B：在信号 N 处启用同步 3)</td></tr>
<tr><td rowspan="3">1_B：设为起始值并继续计数</td><td colspan="2" rowspan="3"></td><td rowspan="3"></td><td colspan="3">101_B：Capture</td></tr>
<tr><td colspan="3">110_B：无功能的数字量输入</td></tr>
<tr><td colspan="3">111_B：无效</td></tr>
<tr><td>17</td><td colspan="8">DI1 的特性：
请参见字节 16</td></tr>
<tr><td>18</td><td colspan="8">预留 2)</td></tr>
<tr><td rowspan="12">19</td><td>频率：</td><td colspan="3" rowspan="12">预留 2)</td><td colspan="4">输入延迟：</td></tr>
<tr><td>0_B：一次</td><td colspan="4">0000_B：无</td></tr>
<tr><td>1_B：周期性</td><td colspan="4">0001_B：0.05 ms</td></tr>
<tr><td rowspan="9"></td><td colspan="4">0010_B：0.1 ms</td></tr>
<tr><td colspan="4">0011_B：0.4 ms</td></tr>
<tr><td colspan="4">0100_B：0.8 ms</td></tr>
<tr><td colspan="4">0101_B：1.6 ms</td></tr>
<tr><td colspan="4">0110_B：3.2 ms</td></tr>
<tr><td colspan="4">0111_B：12.8 ms</td></tr>
<tr><td colspan="4">1000_B：20 ms</td></tr>
<tr><td colspan="4">1001 到 1111_B：无效</td></tr>
</table>

位 → 字节 ↓	位 7	位 6	位 5	位 4	位 3	位 2	位 1	位 0
20...43	值							
20...23	计数上限 3)： DINT：取值范围：–2147483647 至 2147483647_D 或 –7FFFFFFF 至 $7FFFFFFF_H$							
24...27	比较值 0： 工作模式计数：DINT：取值范围：–2147483648 至 2147483646_D 或 –80000000 至 $7FFFFFFE_H$； 测量模式：REAL：浮点数，采用为所测量变量组态的单位							
28...31	比较值 1： 工作模式计数：DINT：取值范围：–2147483647 至 2147483647_D 或 –7FFFFFFF 至 $7FFFFFFF_H$； 测量模式：REAL：浮点数，采用为所测量变量组态的单位							
32...35	起始值 3)： DINT：取值范围：–2147483648 至 2147483647_D 或 –80000000 至 $7FFFFFFF_H$							
36...39	计数下限 3)： DINT：取值范围：–2147483648 至 2147483646_D 或 –80000000 至 $7FFFFFFE_H$							
40...43	更新时间： DINT：取值范围（以 µs 为单位）：0 到 25000000_D							
44	达到限值和门启动时的计数器特性							
44	对门启动的响应 3)：		对超出计数限值的响应 3)：			超出计数限值时复位 3)：		
	00_B：设为起始值		000_B：停止计数			000_B：至另一个计数限值		
	01_B：以当前值继续		001_B：继续计数			001_B：至起始值		
	10 到 11_B：无效		010 到 111_B：无效			010 到 111_B：无效		

<table>
<tr><td>位 →
字节 ↓</td><td>位 7</td><td>位 6</td><td>位 5</td><td>位 4</td><td>位 3</td><td>位 2</td><td>位 1</td><td>位 0</td></tr>
<tr><td>45</td><td colspan="8">指定测量值</td></tr>
<tr><td rowspan="8">45</td><td colspan="3" rowspan="8">预留 2)</td><td colspan="4">速度测量的时基：</td><td colspan="2">测量变量：</td></tr>
<tr><td colspan="4">000_B：1 ms</td><td colspan="2">00_B：频率</td></tr>
<tr><td colspan="4">001_B：10 ms</td><td colspan="2">01_B：周期</td></tr>
<tr><td colspan="4">010_B：100 ms</td><td colspan="2">10_B：速度</td></tr>
<tr><td colspan="4">011_B：1 s</td><td colspan="2">11_B：完整 SSI 帧</td></tr>
<tr><td colspan="4">100_B：60 s/1 min</td><td colspan="2" rowspan="2"></td></tr>
<tr><td colspan="4">101 到 111_B：无效</td></tr>
<tr><td>46</td><td colspan="8" rowspan="2">每单位增量数：
UINT：取值范围：1 到 65535_D</td></tr>
<tr><td>47</td></tr>
<tr><td>48</td><td colspan="8">设置滞后范围：
取值范围：0 到 255_D：</td></tr>
<tr><td>49...51</td><td colspan="8">适用于 SSI 绝对编码器的参数</td></tr>
<tr><td>49</td><td colspan="3">预留 2)</td><td colspan="5">帧长度 4)：
10 至 40_D：取值范围</td></tr>
<tr><td>50</td><td colspan="3">预留 2)</td><td colspan="5">位置值的 LSB 位号：
0 至 38_D：取值范围</td></tr>
<tr><td>51</td><td colspan="3">预留 2)</td><td colspan="5">位置值的 MSB 位号：
0 至 39_D：取值范围</td></tr>
</table>

1) 通过将相应位置 1 激活特定参数。

2) 预留位必须置 0。

3) 对于信号类型“绝对编码器 (SSI)”：预留 2)

4) 在等时同步模式下，该参数会影响同步域的等时同步参数。由于未在 RUN 模式下检查等时同步参数，因此可能发生上溢。在离线参数分配过程中选择所需时间最长的选项可避免上溢。

快速模式下的数据记录 128 的结构

下表给出了“快速模式”操作模式下的 TM PosInput 1 数据记录 128 的结构。应确保字节 0 到字节 3 的值固定不变。

表格 A- 2　参数数据记录 128：“快速模式”操作模式

位 → / 字节 ↓	位 7	位 6	位 5	位 4	位 3	位 2	位 1	位 0
0...3	**标头**							
0	Major Version = 0				Minor Version = 1			
1	每个通道的参数数据长度 = 48							
2	预留 2)							
3	预留 2)							
4	**操作模式**							
4	预留 2)				工作模式：			
					0000_B：无效			
					0001_B：计数/定位输入			
					0010 到 1111_B：无效			
5	**基本参数**							
5	接口标准：	预留 2)				启用附加诊断中断 1)	针对 CPU STOP 模式的响应：	
							00_B：输出替代值	
							01_B：保持上一个值	
	0_B：RS422，对称						10_B：继续工作	
	1_B：TTL (5 V)，非对称						11_B：无效	

位 → / 字节 ↓	位 7	位 6	位 5	位 4	位 3	位 2	位 1	位 0
6...7	**计数器输入**（适用于增量编码器和脉冲编码器的参数）							
6	预留 2)		信号评估：		信号类型：			
			00_B：单重		0000_B：脉冲 (A)			
			01_B：双重		0001_B：脉冲 (A) 和方向 (B)			
			10_B：四重		0010_B：向上计数 (A)，向下计数 (B)			
			11_B：无效		0011_B：增量编码器（A、B 相移）			
					0100_B：增量编码器（A、B、N）			
					0101_B：绝对编码器 (SSI)			
					0110 到 1111_B：无效			
7	针对信号 N 的响应：		反转方向 1)	启用断线诊断中断 1)	滤波频率 4)：			
	00_B：对信号 N 无响应				0000_B：100 Hz			
	01_B：在信号 N 处同步				0001_B：200 Hz			
	10 到 11_B：无效				0011_B：1 kHz			
					0100_B：2 kHz			
					0101_B：5 kHz			
					0110_B：10 kHz			
					0111_B：20 kHz			
					1000_B：50 kHz			
					1001_B：100 kHz			
					1010_B：200 kHz			
					1011_B：500 kHz			
					1100_B： 1 MHz			
					1101 到 1111_B：无效			

<table>
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<tr><td>6...7</td><td colspan="8">计数器输入（适用于 SSI 绝对编码器的参数）</td></tr>
<tr><td rowspan="8">6</td><td colspan="3">单稳态触发器时间 4)：</td><td>代码类型：</td><td colspan="4">信号类型：</td></tr>
<tr><td colspan="3">000_B：自动</td><td>0_B：格雷码</td><td colspan="4">0000_B：脉冲 (A)</td></tr>
<tr><td colspan="3">001_B：16 µs</td><td>1_B：二进制码</td><td colspan="4">0001_B：脉冲 (A) 和方向 (B)</td></tr>
<tr><td colspan="3">010_B：32 µs</td><td rowspan="5"></td><td colspan="4">0010_B：向上计数 (A)，向下计数 (B)</td></tr>
<tr><td colspan="3">011_B：48 µs</td><td colspan="4">0011_B：增量编码器（A、B 相移）</td></tr>
<tr><td colspan="3">100_B：64 µs</td><td colspan="4">0100_B：增量编码器（A、B、N）</td></tr>
<tr><td colspan="3">101 到 111_B：无效</td><td colspan="4">0101_B：绝对编码器 (SSI)</td></tr>
<tr><td colspan="4">0110 到 1111_B：无效</td></tr>
<tr><td rowspan="9">7</td><td colspan="2">奇偶校验 4)：</td><td rowspan="9">反转方向 1)</td><td rowspan="9">启用断线诊断中断 1)</td><td rowspan="9">预留 2)</td><td colspan="2">传输速率 4)：</td></tr>
<tr><td colspan="2">00_B：无</td><td colspan="2">000_B：125 kHz</td></tr>
<tr><td colspan="2">01_B：偶校验</td><td colspan="2">001_B：250 kHz</td></tr>
<tr><td colspan="2">10_B：奇校验</td><td colspan="2">010_B：500 kHz</td></tr>
<tr><td colspan="2">11_B：无效</td><td colspan="2">011_B：1 MHz</td></tr>
<tr><td></td><td></td><td colspan="2">100_B：1.5 MHz</td></tr>
<tr><td></td><td></td><td colspan="2">101_B：2 MHz</td></tr>
<tr><td></td><td></td><td colspan="2">110 到 111_B：无效</td></tr>
<tr><td>8...9</td><td colspan="8">预留 2)</td></tr>
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<tr><td>位 →
字节 ↓</td><td>位 7</td><td>位 6</td><td>位 5</td><td>位 4</td><td>位 3</td><td>位 2</td><td>位 1</td><td>位 0</td></tr>
<tr><td>10...15</td><td colspan="8">DQ 的特性</td></tr>
<tr><td rowspan="7">10</td><td colspan="4">设置输出 (DQ1)：</td><td colspan="4">设置输出 (DQ0)：</td></tr>
<tr><td colspan="4">0000B：无功能的数字量输出</td><td colspan="4">0000B：无功能的数字量输出</td></tr>
<tr><td colspan="4">0001B：在比较值和计数器上限之间</td><td colspan="4">0001B：在比较值和计数器上限之间</td></tr>
<tr><td colspan="4">0010B：比较值和计数器下限之间</td><td colspan="4">0010B：比较值和计数器下限之间</td></tr>
<tr><td colspan="4">0011B：在比较值持续一个脉宽时间</td><td colspan="4">0011B：在比较值持续一个脉宽时间</td></tr>
<tr><td colspan="4">0100B：比较值 0 和 1 之间</td><td colspan="4" rowspan="2">0100B 到 1111B：无效</td></tr>
<tr><td colspan="4">0101 到 1111B：无效</td></tr>
<tr><td rowspan="5">11</td><td colspan="2">计数方向 (DQ1)：</td><td colspan="2">计数方向 (DQ0)：</td><td rowspan="5">预留 2)</td><td rowspan="5">预留 2)</td><td rowspan="5">DQ1 的替代值</td><td rowspan="5">DQ0 的替代值</td></tr>
<tr><td colspan="2">00B：保留</td><td colspan="2">00B：保留</td></tr>
<tr><td colspan="2">01B：向上</td><td colspan="2">01B：向上</td></tr>
<tr><td colspan="2">10B：向下</td><td colspan="2">10B：向下</td></tr>
<tr><td colspan="2">11B：双向计数</td><td colspan="2">11B：双向计数</td></tr>
<tr><td>12</td><td colspan="8" rowspan="2">脉冲持续时间 (DQ0)：
UINT：取值范围（以 ms/10 为单位）：0 到 65535D</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td><td colspan="8" rowspan="2">脉冲持续时间 (DQ1)：
UINT：取值范围（以 ms/10 为单位）：0 到 65535D</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td colspan="8">DI0 的特性</td></tr>
<tr><td rowspan="10">16</td><td rowspan="10">预留 2)</td><td>边沿选择 (DI0)：</td><td rowspan="2">选择电平 (DI0)：</td><td rowspan="10">预留 2)</td><td colspan="4">设置 DI 的功能 (DI0)：</td></tr>
<tr><td>00B：无效</td><td colspan="4">000B：门启动/停止（电平触发）3)</td></tr>
<tr><td>01B：处于上升沿</td><td rowspan="2">0B：高电平有效</td><td colspan="4">001B：门启动（边沿触发）3)</td></tr>
<tr><td>10B：处于下降沿</td><td colspan="4">010B：门停止（边沿触发）3)</td></tr>
<tr><td rowspan="2">11B：无效</td><td rowspan="2">1B：低电平有效</td><td colspan="4">011B：同步 3)</td></tr>
<tr><td colspan="4">100B：在信号 N 处启用同步 3)</td></tr>
<tr><td rowspan="4"></td><td rowspan="4"></td><td colspan="4">101B：无效</td></tr>
<tr><td colspan="4">110B：无功能的数字量输入</td></tr>
<tr><td colspan="4">111B：无效</td></tr>
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<table>
<tr><th>位 →
字节 ↓</th><th>位 7</th><th>位 6</th><th>位 5</th><th>位 4</th><th>位 3</th><th>位 2</th><th>位 1</th><th>位 0</th></tr>
<tr><td>17</td><td colspan="8">DI1 的特性：
请参见字节 16</td></tr>
<tr><td>18</td><td colspan="8">预留 2)</td></tr>
<tr><td rowspan="11">19</td><td>频率：</td><td colspan="2">同步计数方向</td><td rowspan="11">预留 2)</td><td colspan="4">输入延迟：</td></tr>
<tr><td>0_B：一次</td><td colspan="2">00_B：无效</td><td colspan="4">0000_B：无</td></tr>
<tr><td>1_B：周期性</td><td colspan="2">01_B：向上</td><td colspan="4">0001_B：0.05 ms</td></tr>
<tr><td rowspan="10"></td><td colspan="2">10_B：向下</td><td colspan="4">0010_B：0.1 ms</td></tr>
<tr><td colspan="2">11_B：双向计数</td><td colspan="4">0011_B：0.4 ms</td></tr>
<tr><td colspan="2" rowspan="9"></td><td colspan="4">0100_B：0.8 ms</td></tr>
<tr><td colspan="4">0101_B：1.6 ms</td></tr>
<tr><td colspan="4">0110_B：3.2 ms</td></tr>
<tr><td colspan="4">0111_B：12.8 ms</td></tr>
<tr><td colspan="4">1000_B：20 ms</td></tr>
<tr><td colspan="4">1001 到 1111_B：无效</td></tr>
<tr><td>20...43</td><td colspan="8">值</td></tr>
<tr><td>20...23</td><td colspan="8">计数上限 3)：
取值范围：1 至 33554431_D 或 1 至 $01FFFFFF_H$</td></tr>
<tr><td>24...27</td><td colspan="8">比较值 0：
取值范围：0 至 33554430_D 或 0 至 $01FFFFFE_H$</td></tr>
<tr><td>28...31</td><td colspan="8">比较值 1
取值范围：1 至 33554431_D 或 1 至 $01FFFFFF_H$</td></tr>
<tr><td>32...35</td><td colspan="8">起始值 3)：
取值范围：0 至 33554431_D 或 0 至 $01FFFFFF_H$</td></tr>
<tr><td>36...39</td><td colspan="8">计数器下限 3):
取值范围：0 至 33554430_D 或 0 至 $01FFFFFE_H$</td></tr>
<tr><td>40...43</td><td colspan="8">预留 2)</td></tr>
</table>

位 → / 字节 ↓	位 7	位 6	位 5	位 4	位 3	位 2	位 1	位 0
44	**达到限值和门启动时的计数器特性**							
44	针对门启动的响应 3)：		针对超出计数限值的响应 3)：			在超出计数限值时复位 3)：		
	00_B：设为起始值		000_B：停止计数			000_B：至其它计数限值		
	01_B：以当前值继续		001_B：继续计数			001_B：至起始值		
	10 到 11_B：无效		010 到 111_B：无效			010 到 111_B：无效		
45...47	预留 2)							
48	设置迟滞范围： 取值范围：0 到 255_D：							
49...51	**适用于 SSI 绝对编码器的参数**							
49	预留 2)		帧长度 4)： 10 到 40_D：取值范围					
50	预留 2)		位置值的 LSB 位号： 0 到 38_D：取值范围					
51	预留 2)		位置值的 MSB 位号： 0 到 39_D：取值范围					

1) 通过将相应位设置为 1 启用特定参数。

2) 预留位必须设置为 0。

3) 对于信号类型“绝对编码器 (SSI)”：预留 2)

4) 在等时同步模式下，该参数会影响同步域的等时同步参数。由于未在 RUN 模式下检查等时同步参数，因此可能发生上溢。在离线参数分配过程中选择所需时间最长的选项可避免上溢。

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* Contains an implementation class for splay_tree_.
*/
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