Power Focus 6000

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配置指南

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⚠ 警告

请阅读所有安全警告和操作说明。
不遵守安全警告和说明可能导致电击、火灾和/或严重的伤害。
保存所有警告和说明以备日后参考

Atlas Copco

目录

概览

⚠ 警告 存在财产损失或严重受伤的风险

确保在操作工具前阅读、了解并遵守各项操作说明。若不遵守所有操作说明，可能会造成电击、火灾、财产损失和/或严重的人身伤害。

- 阅读所有随本系统不同部分提供的安全信息。
- 阅读针对安装、操作和维护本系统不同部分的产品说明。
- 阅读有关本系统及其中零件的所有本地安全法规。
- 保存所有安全信息和说明，以备将来参考。

注意 更改参数可能会导致工具性能降低，也可能会减缓产量。

注意

在工作环境下，许多情况可能影响拧紧流程，为此须对结果进行验证。在此，我们要求用户遵守相关标准和/或法规，在出现可能影响拧紧结果的情况后，检查安装的扭矩和旋转方向。此类情况的示例包括但不限于：

- 工具系统初始安装
- 更改部件批次、螺栓、螺钉批次、工具、软件、配置或环境
- 更改通风或电气连接
- 更改管路人体工程学特性、流程、质量程序或操作法
- 更换操作员
- 任何影响拧紧流程结果的其他变更

检查应达到以下目的：

- 确保未因发生的影响情况改变接头状况。
- 在设备初始安装、维护或修理后实施。
- 至少在每次换班后检查一次或以合适的频率进行检查。

简介

本节对配置指南进行了描述。

配置手册说明

本配置手册介绍了如何设置和配置 Power Focus 6000。

修订历史

修订	更改
1.6	本版为 Power Focus 6000 配置指南的第一版官方发布版本。
2.0	添加或更新的部分： ■ 设置:工具警报 ■ 工具配置：工具连接、工具维护和无线工具的内部无线局域网 ■ 拧紧配置：拧松步骤 ■ 拧紧结果：实时结果、存储的结果、NOK 结果的状态 ■ 虚拟站 ■ Power Focus 6000 的事件代码
2.1	添加或更新的部分： ■ 设置:现场总线 ■ 控制器菜单 - 拧紧：电流监测和真实角度补偿 ■ 四步拧紧 ■ 系统管理：导出的 csv 文件格式 ■ 虚拟站：I/O 诊断和现场总线 ■ 附录 A：紧急停止
2.3	添加或更新的部分： ■ 系统设置：网络配置 ■ 系统设置：首选项 ■ 系统设置：协议配置 ■ 系统设置：拧紧 ■ 拧紧：时间监控和扭矩调整因数 ■ ST Wrench ■ 源 ■ 附件配置：工具配置、启动条件和套筒选择器配置 ■ 系统管理：导出/导入 ■ 工具配置：ST Wrench ■ 附录 A：前部连接

修订	更改
2.4	添加或更新的部分： ■ 设置:许可管理器 ■ 设置:PIN 编码 ■ 设置:配置启动画面 ■ 拧紧：停用拧紧、角度测量条件、“触发器丢失、扭矩调整因数 ■ 工具健康状态和电池检查 ■ 控制器健康状态和电池检查 ■ 脉冲策略 ■ 3 步拧紧 ■ 设备：附件总线 ■ 设备：LED 光环 ■ 设备：EHMI ■ 设备：现场总线诊断 ■ 导出/导入
2.5	添加或更新的部分： ■ 多步骤拧紧策略 ■ 选择器确认 ■ 已保存位 ■ 一般虚拟站 ■ WIFI 套筒选择器 ■ 多个 PIN ■ 外部正常 ■ 脉冲工具运行警报 ■ 手动模式虚拟站

目标群体

本配置指南用于为任何操作或维护 Power Focus 6000 系统的人提供指导。

前提条件

任何希望详细了解 Power Focus 6000 的人均可通过阅读本指南获益。

要完全了解指南中介绍的技术知识，我们建议：

- 了解拧紧技巧
- 通过操作之前版本的 Power Focus 获得经验

版式规则

下表给出了本文中采用的排版和命名规则：

格式	解释
GUI 对象	菜单选项、GUI 对象和按钮。
参数	参数名称、事件代码和故障代码。
<输入>	占位符表示您必须提供（输入）的信息。

格式	解释
GUI 路径 >	导航辅助帮助您追踪图形用户界面中的位置。

规则

术语与定义

有关术语和定义的列表，请参见*参考资料 [页次 125]*。

Power Focus 用户界面

本节介绍如何开始使用控制器界面，并概述控制器功能。

操作和处理

通过使用控制器前面板，可设置并配置 Power Focus 6000。您也可以在连接的 PC 上浏览到控制器的 IP 地址，通过 Web GUI 访问控制器界面。请参见 *通过 WEB GUI 访问控制器。 [页次 18]*。

前面板

前面板包含一个触摸显示屏和专用的按钮。

	名称	说明
	1. Display	一个带有触摸屏的彩色显示器，显示配置视图和结果。
	2. 专用按钮	专用功能按钮

前面板按钮

提供这些按钮用作 WEB GUI 中可点击的图标。

按钮	名称	说明
	**主页**	进入主菜单屏幕。
	**结果**	进入实时结果视图。

触摸屏按钮

按钮	名称	说明
	**添加**	添加一个附加项。
	**后退**	返回之前的视图。
	**向上滚动/向下滚动**	在相对于屏幕过长的列表中进行移动。
	**最大化/最小化**	通过参数最大或最小化某区域。

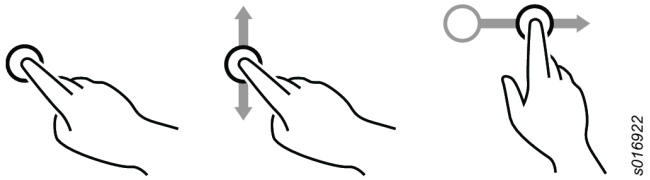
按钮	名称	说明
	（在列表中）返回	在列表页面间向后（和向前）移动。
	“Close”（关闭）	点击以关闭窗口。
	注意	表示参数配置错误的标记。
	主页	进入主菜单屏幕。 仅在 WEB GUI 中提供。
	转至结果	进入实时结果屏幕。 仅在 WEB GUI 中提供。

导航

可以通过点击某个菜单项或者在显示器上的项目中移动手指（拖动）在控制器 GUI 中浏览。

通过点击所需选项选定选项。

要在文本框中输入数据，点击文本框，显示屏上显示一个键盘。



通过手指浏览

Web GUI

Web 界面与控制器显示屏几乎相同。这使得能够通过在连接到控制器的计算机上使用 Web 浏览器来对控制器进行配置和编程。请参见 *网络配置 [页次 17]*。

用户可以同时从控制器和 Web 界面对控制器编程。

菜单概览

控制器提供多个菜单，可配置拧紧和硬件附件、执行工具维护操作、管理软件和查看报告。

拧紧菜单

Tightening（拧紧）菜单列出控制器上存储用于单独拧紧的拧紧程序。有关拧紧配置的说明，请参阅 **Tightening**（拧紧）菜单。

参见控制器菜单 - 拧紧 [页次 32]，了解如何设置和配置拧紧的更多信息。

批次序列菜单

Batch （批次）菜单列出控制器上存储的批次序列。“批次序列”是各种组合中一个或多个重复性拧紧程序。可以在 **Batch sequence** （批次序列）菜单中创建和配置批次序列。

参见*批次配置 [页次 74]*，了解如何设置和批次序列的更多信息。

来源菜单

Sources （来源）菜单列有适用的选项，可通过不同硬件输入的数字控制所选的拧紧程序，例如某个拧紧程序或批次序列。条码枪配置在 Sources（来源）菜单中完成。

参见*源 [页次 85]*（来源），了解如何设置和配置由各种数字输入控制的拧紧任务之更多信息。

工具菜单

Tool（工具）菜单提供有关与控制器连接的工具之信息。此菜单也是无线工具与控制器相连之处。工具参考产品，当工具被维修和校准时，是 Tool（工具）菜单中可用的部分资料。

有关更多信息，请参见*工具配置 [页次 27]* 。

虚拟站点菜单

虚拟站点是控制器系统的软件抽象概念。在 Virtual station（虚拟站点）菜单中，不同的来源、附件、工具和任务都被分配至虚拟站点。虚拟站点的配置在 Virtual station（虚拟站点）菜单中进行。

有关虚拟站点的更多信息，请参见*虚拟站点 [页次 76]* 。

控制器菜单

Controller（控制器）菜单列出软硬件组件。
在控制器中列出存储和使用的软件版本并可以对其进行更新。处理许可管理器，提供更多功能。此外，也可从或向控制器导出或导入设置。

参见 *系统管理 [页次 107]*，了解控制器管理的更多信息。

配置菜单

附件配置列表在 **Configurations**（配置）菜单中提供。可以配置如工具配件、I/O 扩展器、内部 I/O、堆叠灯、操作面板和套筒选择器等此类附件。数字 I/O 信号映射到按钮、灯、开关和连接器。

参见 *配置 [页次 89]*，了解如何配置附件的更多信息。

报告菜单

在**报告** 菜单中，列出拧紧结果和事件。

有关报告结果的更多信息，请参见*拧紧结果 [页次 103]* 。

设置菜单

Settings（设置）菜单可用于设定控制器特定设置，如语言、PIN 码、无线网络、使用的现场总线等。

参见*系统设置 [页次 17]*，了解有关常规设置的更多信息。

帮助菜单

帮助菜单包含了关于控制器的有用帮助部分。提供多种语言版本的 PDF 文件以供下载。

Power Focus 6000 配置概述

要更好了解系统，本操作说明大致介绍了开始使用本系统所需的不同步骤。本节并未涵盖系统的各项功能，但重点介绍了最常用的基本功能。

1. 确定使用哪种工具。使用的工具种类影响拧紧策略的可用性。
2. 本工具的主要用途是执行拧紧。这可通过定义 **tightening program**（拧紧程序，其中含所有相关的拧紧参数，如目标角度和目标扭矩）实现。参见*控制器菜单 - 拧紧 [页次 32]*，了解创建拧紧程序的更多详情。

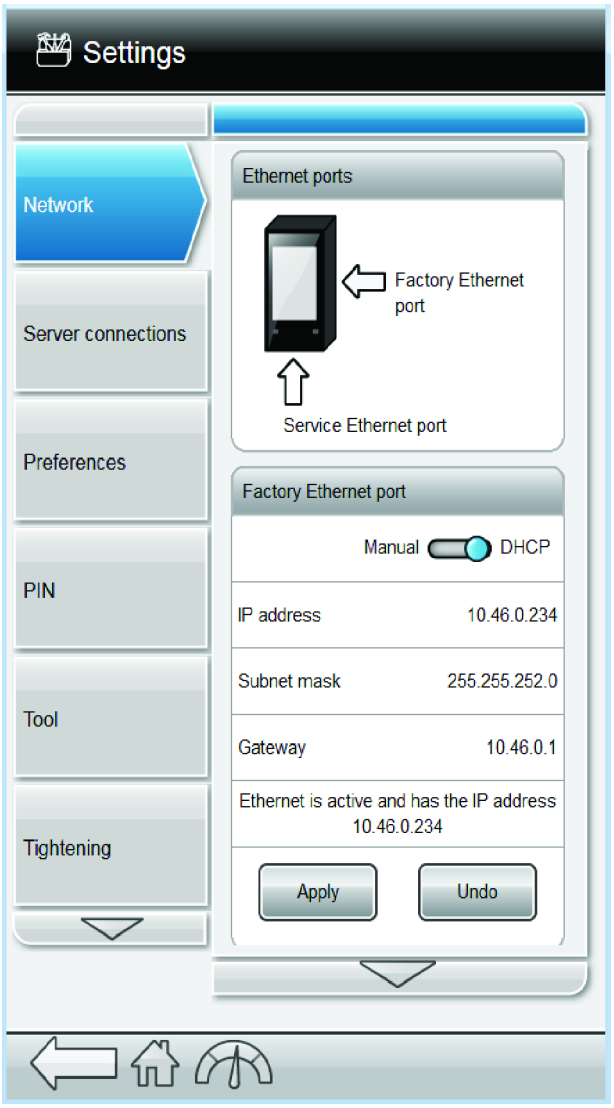
3. 可以将一个或多个拧紧程序添加至 **Batch Sequence**（批次序列），用作一系列拧紧程序。例如，批次序列可以为一个拧紧程序的特定拧紧次数或不同拧紧程序的序列。参见*批次配置 [页次 74]*，了解创建批次序列的更多详情。
4. 创建 **Virtual Station**（虚拟站点）并为其指定工具。虚拟站点在控制器和工具之间用作接口，从而将多个工具与单个物理控制器相连。即使仅将一个工具与控制器相连，也需要虚拟站点。
5. 向虚拟站点分配一个任务。此任务既可是拧紧程序、批次序列，也可是指定的数字输入（如从条形码枪输入）。分派给虚拟站点的工具将能够立即执行此任务。参见*虚拟站点 [页次 76]*，了解设定虚拟站点的详情。

系统设置

网络配置

设置 > 网络

Power Focus 6000可设定为通过 Atlas Copco 软件 ToolsTalk 或本地区域网络 (LAN)上的 Web 浏览器进行访问。此外，还可以通过连接的 PC 访问，因为它采用 IPv4 协议。



控制器的 IP 地址。

只可以配置工厂以太网端口。服务以太网端口具有一个不能连接到本地网络的指定 IP 地址：169.254.1.1。

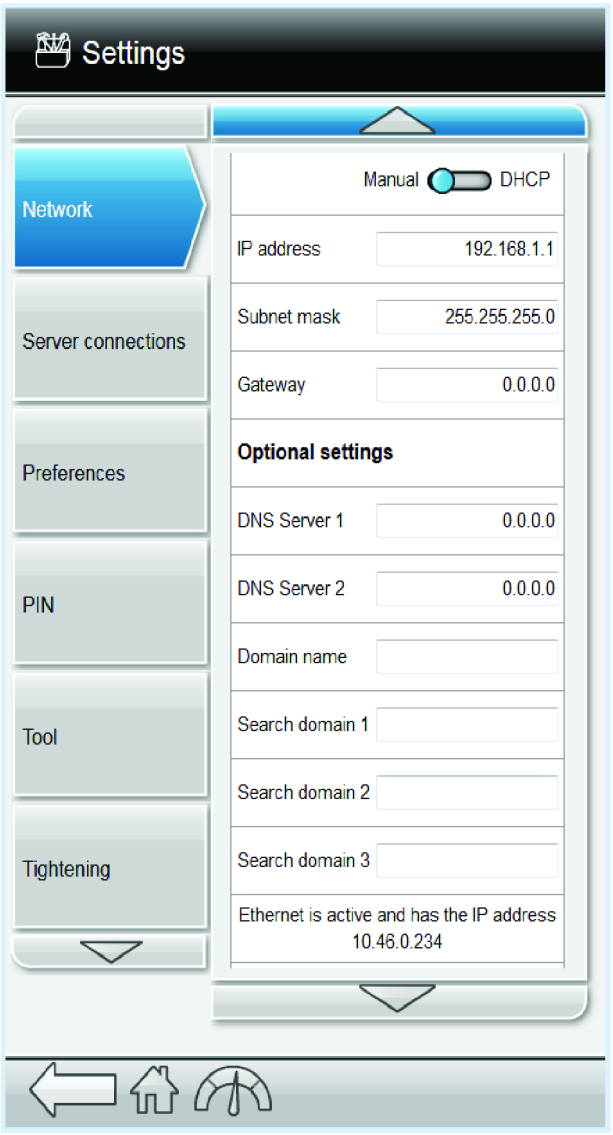
访问 LAN 上的控制器

将网线连接到工厂以太网端口，然后手动指定所需的信息，或者如果可用，使用 DHCP 服务器提供的信息。必需信息包括：

- IP 地址
- 子网掩码
- 网关

这些信息由本地系统管理员提供。

在使用手动选项时，提供适合**DNS 服务器**使用的可选设置。



DNS 服务器配置

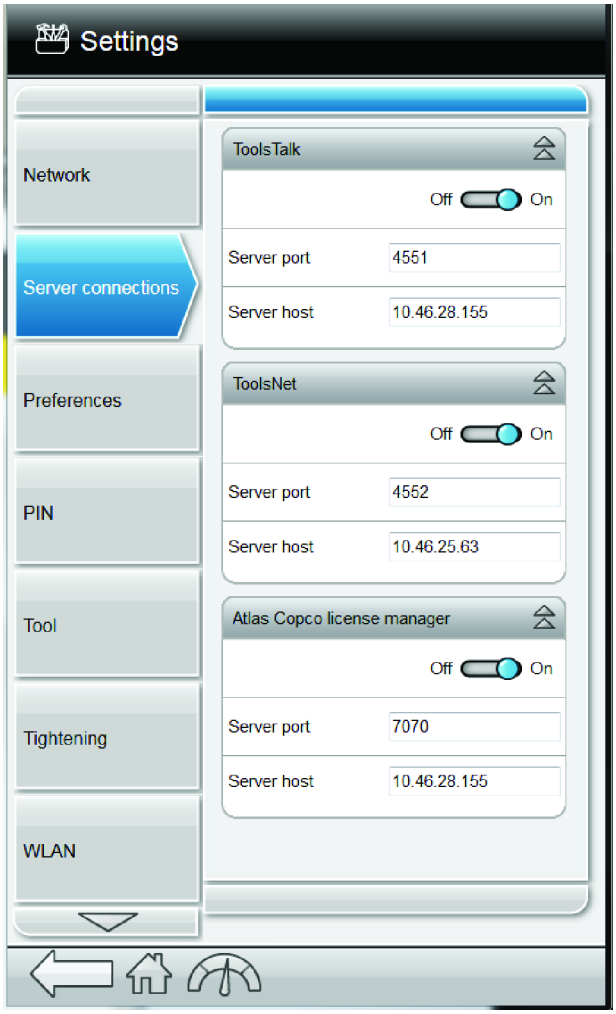
通过 WEB GUI 访问控制器。

用直接贯通以太网电缆(RJ45)将 PC 与服务以太网端口相连。通过 Web 浏览器的 IP 地址访问控制器。

协议配置

Settings（设置） > Server connections（服务器连接）

Power Focus 6000 可设为与运行 Atlas Copco 许可管理器，以及两款 Atlas Copco 软件 ToolsTalk 和 ToolsNet 的服务器通信。ToolsTalk 可用于配置一个或多个控制器。ToolsNet 可用于处理结果报告。



服务器设置

配置 ToolsTalk 通讯

要将控制器连接至 ToolsTalk，需在控制器上配置并激活 ToolsTalk 协议设置。

区域	说明
开/关	启用/禁用与 ToolsTalk 服务器的通讯
服务器主机	ToolsTalk 服务器 IP 地址
服务器端口	ToolsTalk 服务器端口

ToolsTalk 通信参数

配置 ToolsNet 通讯

要将控制器连接至 ToolsNet 来收取拧紧结果，需在控制器上配置并激活 ToolsNet 协议设置。

区域	说明
开/关	启用/禁用与 ToolsNet 服务器的通讯
服务器主机	ToolsNet 服务器 IP 地址
服务器端口	ToolsNet 服务器端口

ToolsNet 通信参数

配置许可管理器

将 Atlas Copco 许可管理器与控制器相连，并通过 **Settings**（设置）菜单中的 **Server connections**（服务器连接）选项卡激活控制器上的协议设置。

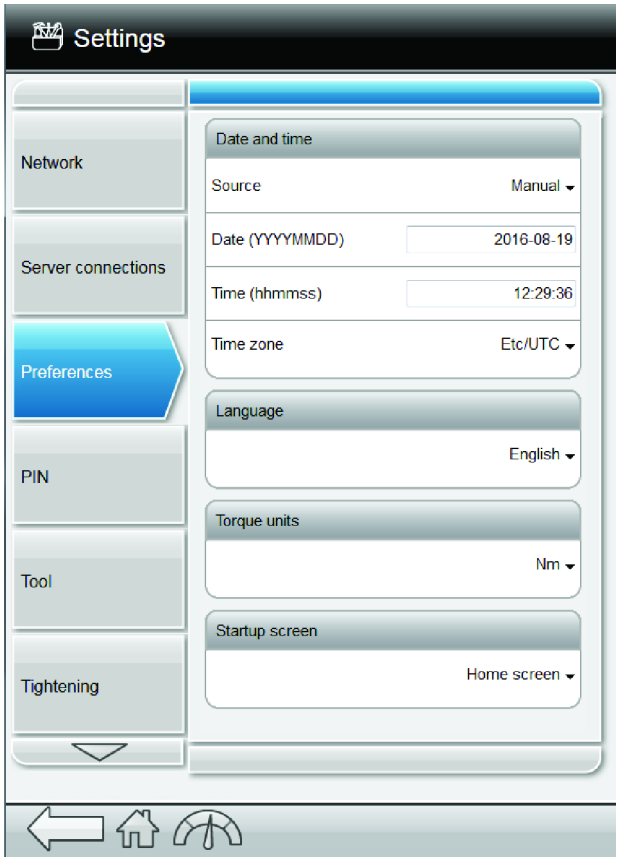
区域	说明
开/关	启用/停用与 Atlas Copco 许可管理器的通信。
服务器主机	Atlas Copco 许可管理器服务器的 IP 地址
服务器端口	Atlas Copco 许可管理器服务器端口

Atlas Copco 许可管理器参数

首选项

设置 > 首选项

“首选项”包含日期和时间、语言、扭矩单位和启动画面等常规设置。



含手动日期和时间的设置

设置日期和时间

必须设置日期和时间，以便活动和结果显示时带有正确的时间戳。

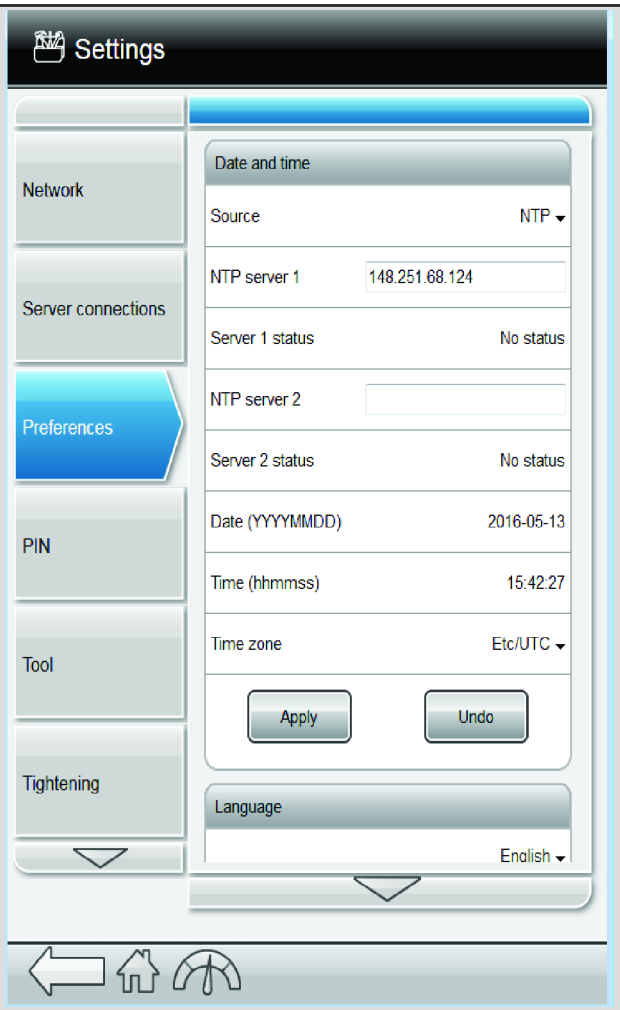
通过以下三种可用来源中的一种检索时间：

- **手册**
- **NTP**
- **ToolsNet**

在将来源设为**手动**时，需手动设置日期、时间和时区。

在将来源设为**NTP**时，将从 NTP 服务器定义在 GUI 中的数据检索日期和时间。

在将来源设为**ToolsNet**时，将从 ToolsNet 服务器中检索日期和时间。



将 NTP 的日期和时间设为来源

区域	说明
来源	获取时间的起始源。
日期	如果将来源设为手动，则需手动输入日期。
时间	如果将来源设为手动，则需手动输入时间。
时间区	时间区既可为本地时区，也可为 UTC 等标准时区（协调世界时）
NTP 服务器	NTP 服务器的 IP 地址为控制器提供日期和时间。

设定日期和时间的参数

设置显示的控制器语言

控制器 GUI 被翻译为 12 种语言。要更改 GUI 的显示语言：

1. 点击或单击当前正在使用的语言名称旁的箭头。
2. 从列表中选择语言。

语言更改立即生效。

语言	在控制器中显示
英语	英语
捷克语	Čeština

语言	在控制器中显示
德语	Deutsch（德语）
西班牙语	Español
法语	Français
韩语	한국어
意大利语	Italiano
日语	日本語
葡萄牙语	Português
俄语	Русский
瑞典语	Svenska
中文	中文

可用的 GUI 语言

设置显示的扭矩单位

选择扭矩值和结果使用的单位。执行拧紧后以及在结果列表中存储后，扭矩结果将以选定的单位显示。

要更改控制器 GUI 中使用的扭矩单位：

1. 点击或单击当前正在使用的单位名称旁的箭头。
2. 从列表中选择单位。

扭矩单位更改立即生效。

单位	说明
cNm	百分之一牛顿米
dNm	十分之一牛顿米
Nm	牛顿米
kNm	千牛顿米
in • lbf	英寸-磅力
ft • lbf	英尺-磅力
in • ozf	英寸-盎司力
ft • ozf	英尺-盎司力
gf • cm	克力-厘米
kgf • cm	千克力-厘米
kgf • m	千克力-米

可用的扭矩单位

设置启动画面

控制器启动时的默认画面为主界面。可以更改结果页面的启动画面。

更改设置的启动画面需要重启控制器或刷新 WEB GUI。

PIN 设置

设置 > PIN

使用 PIN 可防止未授权使用或意外改动控制器。可以将多个用户添加到 PF6000，每个用户设有独立的 PIN。注意：PIN 未与控制器配置关联，主要用于登录原因。

启用 PIN 后，在通过以下方法访问控制器时需要提供 PIN 码

- 通过控制器 GUI
- 通过 WEB GUI

激活 PIN

1. 进入 Settings（设置）菜单并在导航中选择 PIN。单击 Configure（配置）。
2. 在 PIN 窗口中，将开关设为 On（开启）。

   只有在列表中启用至少一个用户/PIN 后，才可以启用 PIN。如果未启用用户/PIN 码，会弹出一条警告信息。
3. 设定不活动超时（单位：秒），以设定不活动时将锁止控制器的时间。

   不活动超时默认值为 20 秒。注意：此为全局设置，无法按用户设定。

配置新用户并分配 PIN

PIN 必须为 0000 - 9999 范围内的四位数。当启用 PIN 时，控制器将在配置的不活动时间后自动锁定。注意：当前最多可以向每个控制器添加 10 个用户。

添加新用户

1. 在 PIN 窗口中，单击列表底部的 **plus**（+）图标。
2. 单击 **Name**（名称）字段，编辑条目。
3. 在用户名窗口，输入用户名和 PIN。

   所有用户名应是唯一的。

   两个字段内的 PIN（输入 PIN 并确认）需要与应用的更改相符。注意：两个字段显示默认 PIN（点），但它们只是占位符，无需用实际 PIN 进行替换。
4. 单击**应用**。

启用/停用用户

1. 在用户列表中，选择您希望启用的用户名左侧之复选框。
2. 要停用 PIN，清空您希望停用的用户名左侧的复选框。

   注意：单击用户名并分别将 **Enabled**（启用）开关设为 On 或 Off，还可以启用和停用 PIN。

删除用户/PIN

1. 在用户列表中，单击用户名右侧的 Delete（删除）图标。

在 PIN 锁定时访问控制器

在访问启用 PIN 的控制器时，会弹出一条要求提供 PIN 的提示信息。无论是通过 WEB GUI、控制器 GUI，还是通过 Tools Talk 访问控制器，均要求提供 PIN 码。

另参见

通过 WEB GUI 访问控制器。 [18]

工具警报

设置 > 工具

设置警报以控制何时对与控制器相连的工具进行维护或校准。

工具保养间隔和其他信息可见于**工具**菜单中的工具视图。

区域	说明
Service indicator alarm（保养指示灯警报）	在达到工具的保养周期时启用警报。
Tool lock after alarm（报警后工具锁住）	保养间隔到期时锁定工具。
校准报警	针对与控制器连接的所有工具启用工具校准警报。

不同的工具警报

拧紧设置

设置 > 拧紧

设置菜单中的拧紧设置用于在拧紧后配置何时停用拧松及何时停用拧紧。

禁用松开	说明
关闭	禁用松开关闭。始终可以将拧紧拧松。
开启 OK 拧紧	针对 OK 拧紧禁用松开。不可对显示拧紧 OK 的拧紧进行拧松。
开启 NOK 拧紧	针对 NOK 拧紧禁用松开。不可对显示拧紧 NOK 的拧紧进行拧松。
始终	禁用松开始终开启。从不可将拧紧拧松。

拧松设置

禁用拧紧	说明
关闭	在拧紧后不得停用拧紧。
开启 OK 拧紧	在显示 OK 拧紧后停用拧紧。
开启 NOK 拧紧	在显示不正常(NOK)拧紧后停用拧紧。
在每次拧紧后	在每次拧紧后停用拧紧。

拧紧的设置

有关其他拧紧设置的信息，请参见 *控制器菜单 - 拧紧 [页次 32]*。

无线局域网

设置 > 无线局域网

控制器中的无线局域网设置激活对无线局域网的使用并指定使用哪个射频通道。

如需关于控制器中的无线工具配置的更多信息，请参见*工具配置 [页次 27]*部分。

事件设置

设置 -> 事件

控制器中可用的事件可以配置为下列一种或若干种状态：

- 已确认
- 已登录
- 已显示

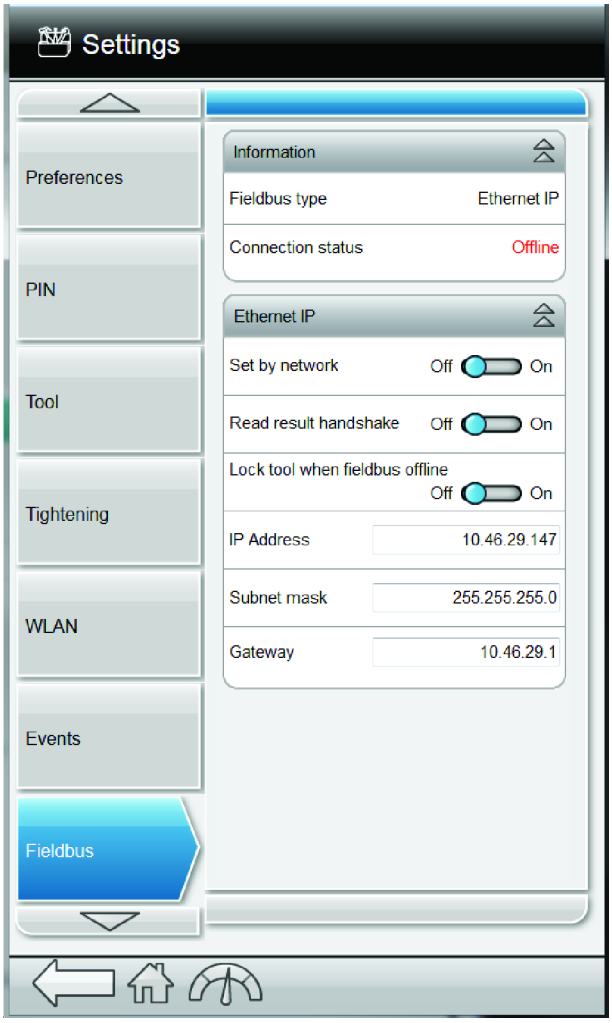
有关事件的更多信息，请参阅*事件 [页次 114]*部分。

现场总线

设置 > 现场总线

现场总线部分由关于使用中的现场总线类型的信息组成。本部分取决于硬件并且为只读。具有使用中的现场总线之一般设置的配置部分可以编辑。

现场总线映射及现场总线映射到虚拟站点的分配采用 ToolsTalk 完成。如需更多信息，请参阅 ToolsTalk 配置指南。



现场总线设置

结果

Settings（设置） > Results（结果）

通过 Results（结果）菜单，用户可在结果列表所示的结果中配置标签名称（详见 **Reports > Results**（报告 > 结果））。

更改 Result Status（结果状态）名称

1. 进入 **Settings**（设置），然后选择 **Results**（结果），单击 **Customized detailed status**（自定义详细状态）。
2. 查找您希望改变的状态名称。
3. 将新的名称填入右侧*New status name*（新状态名称）的相应字段内。

出厂重置

设置 > 出厂重置

可以将控制器重新恢复到原厂设置。

在重置控制器时将删除所有设置、配置和历史数据。只有在完全确定需要此项操作时才执行出厂重置。

执行控制器出厂重置

1. 进入“设置，出厂重置”并单击 **Reset**（重置）按钮

2. 显示弹出窗口，提醒将删除所有数据。单击 Yes（是）。
控制器将重启，以启用新设置。

工具配置

必须将一个工具连接到控制器，使**工具**菜单显示信息。

工具信息

工具信息视图包含用来为维修人员提供关于连接到控制器的工具的准确信息以便其提供足够帮助和支持的信息，或者为操作人员提供哪种工具已连接到控制器的信息。

信息	说明
型号	工具型号名称.
最大扭矩	工具可以针对拧紧使用的最大扭矩。
最大速度	工具的最大旋转速度。
齿轮比	输入齿轮角速度与输出齿轮角速度的比。
序列号	需要产品说明的正确版本时，可能需要提供工具的序列号，以便获取正确的备件或维修说明。
软件版本	工具软件版本。
产品号	工具的产品号或订购号。

工具信息

工具 TAG 信息

只有工具类型为 STwrench 时，才提供工具信息。

信息	说明
标签 id	将可编程的 RFID TAG 识别码数字编程到**端部配件工具**（套筒）中。
扭矩校正系数	在特定情况下，可能需要扩展项来安装此应用.此时，应补偿扳手测量值以显示正确值。 要计算校正系数，请参阅《STwrench 用户指南》印刷品编号 9836 4134 01 第 2.12 版。 参数存储在**端部配件工具**的 RFID TAG 中。
角度校正系数	在特定情况下，可能需要扩展项来安装此应用.此时，应补偿扳手测量值以显示正确值。 要计算校正系数，请参阅《STwrench 用户指南》印刷品编号 9836 4134 01 第 2.12 版。 参数存储在**端部配件工具**的 RFID TAG 中。
额定扭矩	STwrench 的 smartHEAD 包含扭矩传感器并定义扳手额定扭矩。有关信息，请参阅《STwrench 用户指南》印刷品编号 9836 4134 01 第 2.12 版。

STwrench 工具信息

注意 校正系数会改变 STwrench 测量值。它可能导致读数错误。在进行校正前，请参阅《STwrench 用户指南》印刷品编号 9836 4134 01 第 2.12 版。

连接

工具连接区域显示与工具相连的虚拟站点。要设置工具的虚拟站点，请参阅 *将工具连接到虚拟站点 [页次 77]* 一节。

健康状态

健康状态视图包含工具温度有关的信息

工具温度

工具温度（带线工具和电池工具）通过 PF6000 持续监控。受支持的温度单位为摄氏度(° C)和华氏度(° F)，默认单位为摄氏度。可以在两个单位之间切换，无需重启控制器。当工具电机温度或工具电子设备温度超过最大温度时，将锁定工具并显示一条警报(2014)。当工具温度低于温度限值时，系统会自动解锁工具。

工具温度功能不适用于 STwrench 工具。

工具温度监控

用户通过显示器或 Web GUI 可以查看最近测量的工具电子设备及工具电机的温度，以及测量时的具体时间。

1. 单击工具
2. 工具电子设备温度和工具电机温度均列在健康状态栏下。对于脉冲工具，还列出了工具脉冲单位温度。
3. 单击任一条目，可查看峰值温度及时间戳的列表。

维护保养

工具存储保养周期数并统计在需要进行工具维护或保养之前可执行多少次拧紧。

设置维护警报

1. 进入设置，然后选择工具。
2. 将 Service indicator alarm（保养指示警报）设为 On（开启）
3. 进入工具，然后选择您希望设定警报的工具。
4. 将数值写入保养周期字段。

它们仅可以设为 10000 的倍数。除了 10000 倍数以外的任何数字都将四舍五入到 10 000 的最接近倍数。

在使用脉冲工具时，将同时设定拧紧次数和脉冲数的保养周期。无论率先达到哪个周期，都将触发警报。

区域	说明
Last service（上次保养）	执行上次保养的日期和时间。上次保养日期在维修车间设置。Last service date（上次维修日期）被设定为 Reset service count（重设维修次数）按钮按下时的当前日期和时间。
自保养以来的总拧紧次数	自工具第一次使用以来，由工具执行的拧紧总次数。该数值在维修时可用，并将一直保持到下一次维修。
Remaining tightenings（剩余拧紧数）	到下次保养前剩余的拧紧的总数。 该参数仅在控制器 GUI 中可见。
保养间隔	两次维修事件间将要执行的拧紧次数。可以设为 10000 的倍数。
自保养以来的总脉冲	[仅限脉冲工具] 自工具第一次使用以来由工具执行的拧紧总次数。该数值在维修时可用，并将一直保持到下一次维修。
剩余脉冲	[仅限脉冲工具] 到下次保养周期前剩余的脉冲总数。
保养间隔	[仅限脉冲工具] 在两次保养间执行的脉冲数。可以设为 10000 的倍数。
重置保养计数器	重设**保持拧紧**计数器并将**上次维修日期**设定为当前日期。
重置保养数据	[仅限脉冲工具] 重置 Remaining tightenings（剩余拧紧）计数器以及机油状态并将 Last service date（上次维修时间）设为当前日期。

维护参数

校准

工具校准用于控制工具如何与参考传感器相对应。

工具内存中存储的校准值用于调整工具的扭矩传感器提供的扭矩值，以使正确的扭矩值能够显示在控制器上。该控制器会显示上次校准工具的日期。

区域	说明
上次校准日期	最近执行校准的日期和时间。
校准值	校准依据的扭矩值。
下次校准日期	下次需校准工具的日期。

校准参数

准备校准

确保设定好工具和控制器来执行拧紧操作。使用 STanalyser、ACTA 或 BLM Bench 等扭矩参考传感器来设置工具。有关设置说明，请参阅扭矩参考传感器的用户指南。

选择一个拧紧程序，其目标扭矩与您的工具正常使用的拧紧相对应。

有关如何设置并激活合适的拧紧程序，请参阅指南中的基本拧紧设置。

校准工具

通过下列方程，根据控制器和扭矩参考传感器中的扭矩读数计算供工具使用的扭矩值。

1. 在**工具**菜单中，选择要校准的工具并转至**校准**选项。
2. 将发现的原先校准值记录在Calibration value （校准值）文本框中。
3. 请至少进行三次拧紧操作，并使用从控制器和参考传感器（ACTA 或类似传感器）中读取的扭矩值来计算平均扭矩值。
4. 使用**新校准值**等式计算新校准值。
5. 将计算出的数值输入**校准值**文本框并点击**应用**，将新校准值存储在工具存储器中。

电机调谐

电机调谐可调整工具的电机控制单元，以优化性能并最大限度地减少损失。对于电缆工具，应对每个特定的控制器和工具组合执行电机调谐。STB 工具可以转移到另一个控制器，无需执行新的电机调谐。

开始电机调谐

执行电机调谐前，确保工具连接到虚拟站点并且控制器设置为执行拧紧。

电机调谐将需要大约 1 分钟的时间来执行，并且在完成之前将会按顺时针和逆时针方向旋转转轴。

1. 在 Tool（工具）菜单中，点击要执行电机调谐的工具并进入 Motor tuning（电机调谐）。按下工具上的触发器并在 GUI 中选择 Perform（执行）。
2. 点击**确定**以开始**电机调谐**。

   按照屏幕提示操作并按下工具触发器，直至完成工具调谐。

   - 如果电机调谐成功，将显示一个 OK 事件。
   - 如果电机调谐不成功，或者工具触发器在电机调谐还未完成之前已被松开，则将会显示一个 NOK 事件。

用于无线工具的内部无线局域网

Power Focus 6000 控制器内置无线 LAN 射频模块，允许无线工具和控制器通过配对过程相连。建立配对后，只要工具位于控制器的信号范围内，工具将自动连接至控制器。与控制器配对的工具，只能与该特定控制器相连，即使另一个控制器也被设置为使用同样的射频通道也是如此。

控制器中的无线 LAN 射频模块可一次性与三个工具相连。

开始配对过程之前：

- 检查要使用的无线电频道。
- 检查如何使工具进入配对模式。有关如何进行此过程的信息，请参阅 STB 用户指南 (9836 3043 01)，或按照下方说明进行操作。
- 如果可能，保持工具与控制器之间无任何障碍。

将 STB 工具设为配对模式

1. 将（充电）电池与工具断开。
2. 按下工具触发器，同时重新连接电池。
3. 工具 LED 熄灭后，松开工具触发器。
4. 工具 LED 再次亮起后，按压工具触发器。
5. 工具 LED 再次熄灭后，松开工具触发器。两个 LED 都开始闪烁（约 10 秒后）。
6. 此时工具即已处于配对模式下。在工具处于配对模式时，LED 会不断闪烁。

必须等待工具上的两个 LED 都开始闪烁后，才能开始 Power Focus 配对步骤。在 30 秒内发起配对，否则工具可能超时。

将 ST Wrench 设为配对模式

在开始配对前，先关闭 ST Wrench。

1. 打开 ST Wrench。
2. 在自动调节期间，按下以下按钮：
   - 向上
   - 向右
   - 条形码
3. 在调节结束时，扳手进入配对模式。

将无线工具与控制器配对

1. 将“已启用”设为“开启”后会启用内部无线局域网：转至**设置**菜单，然后点击**无线局域网**。将**已启用**开关拖至**开启**。

   如果无线局域网“已启用”开关设置为“关闭”，则无法将工具与控制器配对。已经与内部无线局域网连接的工具在“已启用”开关设为“关闭”时断开。
2. 设置将无线工具与控制器配对时要使用的射频通道：转至**设置**菜单，然后点击**无线局域网**。
3. 在射频通道区域，点击通道列表并选择通道。

   更改通道会让所有与控制器配对的无线工具永久性断开。
4. 转至**工具**菜单并点击右上角的配对图标。

5. 将工具设为配对模式。请参见将无线工具设为配对模式。
6. 在**配对**对话框中，点击**执行**以开始配对过程。

7. 配对过程出现以下任意结果后终止：
   - **配对成功** - 工具与控制器使用选定通道配对完成。
   - Pairing unsuccessful（配对不成功） - 这是由以下任一原因造成：
     - 未在配对过程中检测到工具。确保工具处于信号范围内以及处于配对模式下，然后点击“关闭”，再试一次。
     - 在配对过程中找到多个工具。确保没有其他工具处于配对模式下，然后点击“关闭”，再试一次。
     - 配对已在进行中。请确保控制器上没有执行任何其他配对过程，然后点击“关闭”，再试一次。
     - 配对失败。点击“关闭”，再试一次。

控制器菜单 – 拧紧

拧紧

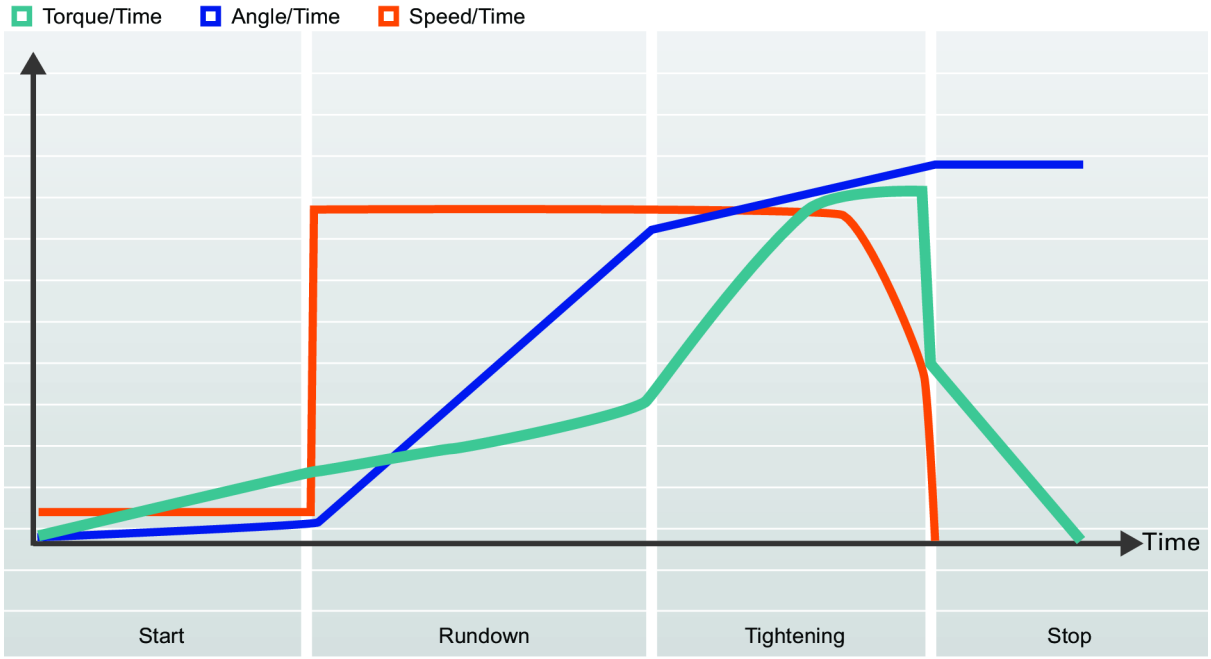
⚠ 警告 存在受伤风险

对拧紧程序配置的更改可能使扭矩、转动方向或拧紧程序目前正使用系统的速度出现异常。这可能导致严重的身体伤害和/或财产损失。

- 在添加新程序或将更改运用到当前程序中后，请检查拧紧程序配置。

Power Focus 6000 拧紧程序需要设定好参数，以执行拧紧。选择一个策略，**Target torque**（目标扭矩）或 **Target angle**（目标角度）是必选的。**Soft start**（软启动）、**Selftap**（自攻）和 **Torque compensation**（扭矩补偿）等其他设置是任选的。此外，还可以通过添加扭矩或螺母旋转角度必须遵守的限制范围来监控整个拧紧过程。

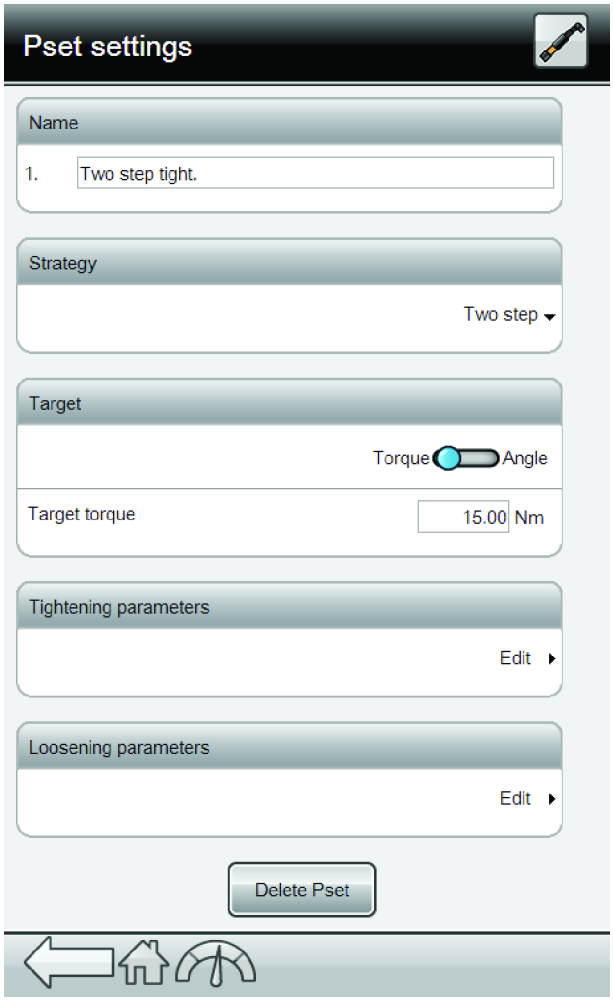
拧紧过程可分成四个步骤：开始、旋入、拧紧和停止。



拧紧程序常规设置

拧紧程序常规设置可用于通过对拧紧程序命名来设定并管理拧紧程序，进行选择拧紧策略、手动或快速编程模式等常规拧紧设置，以及设定**拧紧程序目标值**。

参见 开始步骤 [页次 37]、旋入步骤 [页次 39]、拧紧步骤 [页次 43] 和 停止步骤 [页次 50]，了解拧紧参数。*参见 拧松步骤 [页次 50]*，了解拧松参数。



名称

使用 **Name**（名称）栏，给拧紧程序命名。该名称将与拧紧结果一起存储并发送给 ToolsNet（如果适用）。该名称的最大长度为 32 个字符。

策略

Strategy（策略）设定配合拧紧程序使用的拧紧策略。可用策略及其参数请参见*拧紧策略 [页次 44]*章节。

使用 TurboTight 时的配置模式

当使用 TurboTight 策略时，可以将配置模式在快速编程 (Quick prog) 或者手动配置之间切换。当选定 Quick prog（快速编程）时，除 **Target torque**（目标扭矩）之外，所有参数将重置并重新计算。拧紧参数的重新计算基于建立的参数规则、工具最大扭矩和速度，以及不同参数的相互关联程度。

四步拧紧策略的配置

如需有关四步拧紧的配置信息，请参见*四步拧紧策略 [页次 58]*部分。

配置 ST Wrench

有关配置 ST Wrench 的信息，请参见*ST Wrench [页次 70]*一节。

目标

“快速拧紧”、“两步拧紧”和“三步拧紧”策略允许选择拧紧的目标扭矩或目标角度值。当激活 TurboTight 时，仅提供目标扭矩选项。

时间监控（用时）

实时监控适用于所有拧紧策略，但转动除外。实时监控在角度限制启用后方可使用。实时监控适用于拧紧步骤的旋入步骤和最终步骤。

在采用 TurboTight 拧紧策略时，为最大限度降低拧紧结束之际意外猛拉造成的风险，须确保启用实时监控功能。

由于处理绘制图需要时间，务必需缩短程序用时与步骤用时之间的差值。这在仅包含一个步骤的程序中特别明显。

在使用 STB 工具时，如果打开了所有监控选项，则不可使用实时监控功能。

剩余扭矩校正系数

剩余扭矩校正系数这一术语类似于校准，用于调整电气工具测量的动态扭矩和控制工具测量的剩余扭矩。

Residual torque correlation factor（剩余扭矩校正系数）适用于运行 TurboTight 策略和 TensoPulse 拧紧程序的各项工具。此外，它还向获得控制器支持的电池脉冲工具提供。

当使用不同于 100 的*剩余扭矩校正系数*时，报告的**最终扭矩**不再是工具传感器测量的动态扭矩。

动态扭矩测量使用内部扭矩传感器持续测量扭矩。当达到目标扭矩时，工具停止工作，随之评估并报告结果。传感器中测量的最终扭矩受连接条件、工具速度、齿轮和套筒等影响。

在完成拧紧后，测量剩余扭矩。需要将扭矩持续或重新开始拧紧至更高的级别。剩余扭矩决定着接头的夹紧力。

动态扭矩测量具有高度重复性，但在工具类型和工具速度之间可能有所不同。	手持式校准扭矩扳手测量剩余扭矩精准度高，但鉴于接头余量、扭矩衰减、摩擦或操作技巧等原因，也存在较高变化。

Residual torque correlation factor（剩余扭矩校正系数）用于补偿动态扭矩和剩余扭矩。该系数应通过实验决定。多次执行所选的拧紧程序并记录动态扭矩。此外，还手动测量拧紧，以确定剩余扭矩。

$$\text{Residual torque correletation factor} = \frac{\text{Residual torque}}{\text{Dynamic torque}}$$

可以用剩余扭矩除以动态扭矩计算 *Residual torque correlation factor*（剩余扭矩校正系数）。*Residual torque correlation factor*（剩余扭矩校正系数）以百分比形式表示，默认为 100%。这意味着报告的动态扭矩未被修改。

参数	功能
目标扭矩	为采用 TurboTight 策略的拧紧设定工具目标扭矩。
最终动态扭矩	最终扭矩作为所执行拧紧的结果报告。
动态扭矩	动态扭矩由参考传感器测量。
剩余扭矩	所需的剩余扭矩确保理想的夹紧力。
剩余扭矩校正系数	剩余扭矩和动态扭矩之间的补偿因数

列举一个如何使用扭矩调整的示例。

选择 TurboTight 策略。应将接头拧紧至 12 Nm，以达到所需的夹紧力。执行以下设置

设置示例	值	功能
目标扭矩	12 Nm	控制器中编设的理想目标扭矩
剩余扭矩校正系数	100	剩余扭矩和动态扭矩之间的补偿因数

进行一定次数拧紧。在每次拧紧后，用校准的扭矩扳手检查接头。计算平均值，由此会发现如下结果：

初始参数和结果	值	功能
目标扭矩	12 Nm	控制器中编设的目标扭矩。
最终扭矩	12 Nm	最终扭矩作为所执行拧紧的结果报告。
动态扭矩	12 Nm	源自工具传感器的未补偿测量扭矩。
剩余扭矩	10 Nm	利用校准后扭矩扳手或其他测试工具测量的剩余扭矩。
剩余扭矩校正系数	100 %	剩余扭矩和动态扭矩之间的补偿因数

测试表明，剩余扭矩过低，无法形成所需的夹紧力。计算的剩余扭矩校正系数为 0.83，亦即 83 %。对调整因数进行调节并获得如下结果

最终参数和结果	值	功能
目标扭矩	12 Nm	控制器中编设的目标扭矩。
最终扭矩	12 Nm	最终扭矩作为所执行拧紧的结果报告。
动态扭矩	14.5 Nm	源自工具传感器的未补偿测量扭矩。
剩余扭矩	12 Nm	所需的剩余扭矩确保理想的夹紧力。
剩余扭矩校正系数	83 %	剩余扭矩和动态扭矩之间的补偿因数。

实际上，这表示我们需要用力将钻头拧紧超过目标值，以补偿差值并达到接头所需的扭矩。

务必用同型号工具进行校正并在生产中使用参数配置。

触发器丢失

触发器丢失 NOK 表示一种拧紧程序设置，在达到目标条件时，用于控制是否允许释放工具触发器。可将设置设为“On”或“Off”。下文描述了两种状态。

开关设置	说明
开启	在达到目标条件前释放触发器将导致 NOK 拧紧。
关闭	只要满足所有其他条件，在达到目标条件前释放触发器将会实现 OK 拧紧。

不支持提前释放触发器的默认行为特性。触发器丢失设置中的 NOK 仅向旋转策略提供，默认值为“On”。所有其他策略均应按设为“On”时设置执行。

附件调校

附件调校可以对工具的前附件进行补偿。可以为每个拧紧程序进行补偿。

操作人员可以热切换附件，然后选择针对特定附件调校的拧紧程序。

附件调校适用于所有传统的策略，但 STwrench 除外。

1. 在 **Tightening program settings**（拧紧程序设置）中，将**Attachment tuning enabled**（附件调校启用）设为**Yes**（是）
2. 单击 Tightening parameters（拧紧程序） > **Edit**（编辑）
3. 单击启动步骤。
4. 在 **Attachment tuning**（附件调校）选项下，将**Use attachment tuning**（使用附件调校）设为 **Yes**（是）
5. 为**Gear ratio**（传动比）和**Efficiency tuning**（效率优化）设定所需的参数（参见下表）。

附件调校	说明	默认
附件传动比	需要使用*附件传动比*来补偿角度。 最小：0.5 最大：3.6 套筒转速 = 工具速度/传动比	1.0
效率优化	需要使用附件传动比及*效率优化*来补偿扭矩。 最小：0.5 最大：1.0 例如，0.9 表示 10% 的效率损失。	1.0

附件调校参数

拧紧程序校验和校验错误报告

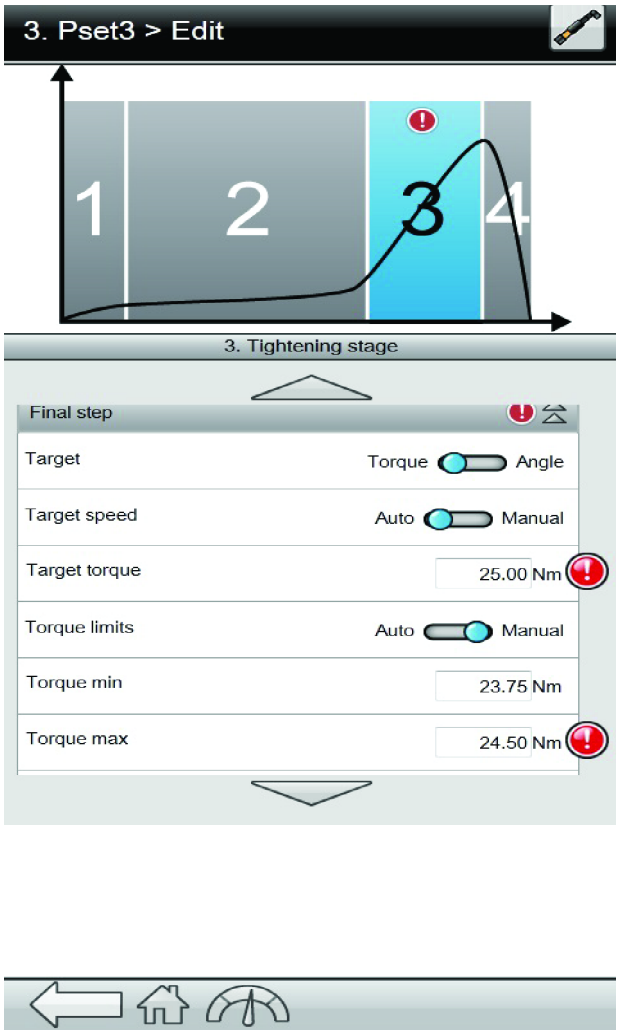
只要输入新的值或对拧紧程序进行改动，拧紧程序会自动根据参数规则和工具特性自动校验。如果校验检测到任何错误，将以错误说明方式报告。

校验错误报告

如果校验给出错误，将在参数旁或造成错误的参数旁显示一个图标。点击该图标，将提供有关错误的简短描述。

示例（参见插图）：

1. **目标扭矩**设置为 25 Nm，“最终扭矩限制范围”设置为**最小扭矩** 23.75 Nm 和**最大扭矩** 24.5 Nm（此值被插图中的弹窗盖住）。
2. 当点击**最大扭矩**参数旁的校验错误图标时，将显示一条有关错误的简短描述，指出**目标扭矩**大于 **最大扭矩**（最大扭矩 <= 目标扭矩）。
3. 要修复错误，可调整**最大扭矩**值，使其大于**目标扭矩**，然后错误图标将消失。



通过拧紧程序校验工具

1. 在拧紧菜单中，选择拧紧程序库或多步骤程序库。必要时在列表中选择特定程序。注意：可以在整个程序列表或单个程序中进行验证。
2. 单击右上角的 tool icon  （工具图标）。
3. 在弹出窗口中，根据拧紧程序选择要验证的工具，并单击 Validate（验证）。
   如果拧紧程序与所选工具不兼容，可以通过带感叹号的红色圈进行指示。

开始步骤

可选启动步骤用来启动拧紧进程、开始套筒和螺纹查找，并提供用来检测重复拧紧的选项。

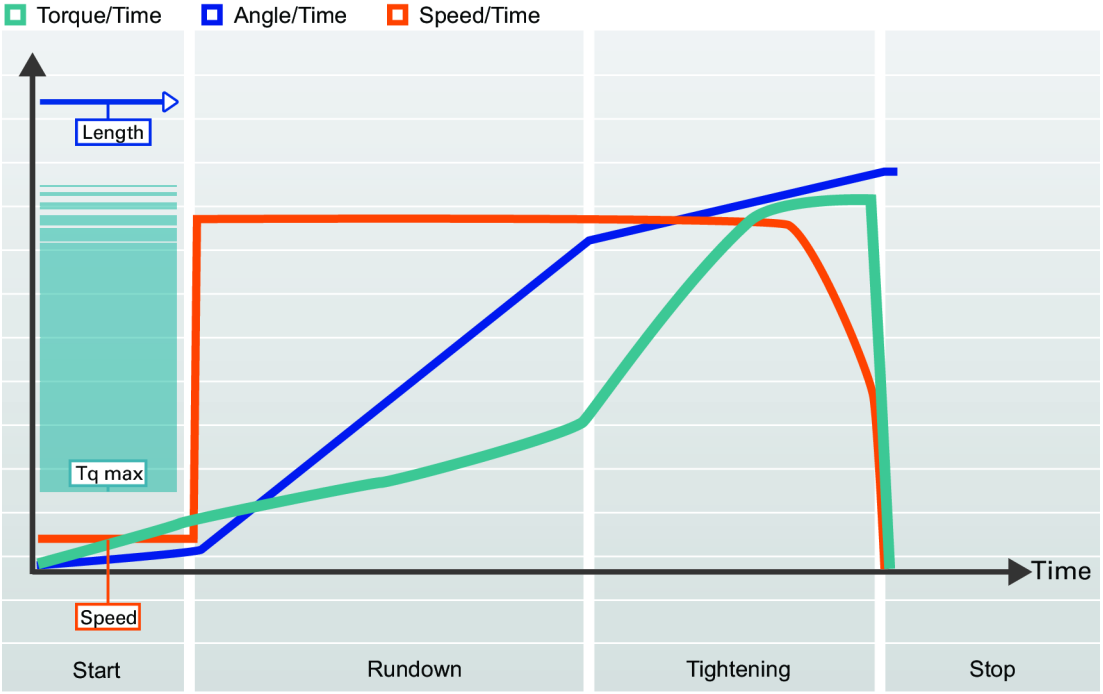
方向

Direction（方向）定义了转轴的拧紧方向是顺时针 (CW) 还是逆时针 (CCW)。除 Three step（三步拧紧）策略中使用的拧松和调整步骤期间，转轴将始终沿该方向转动。

参数	说明	默认值
螺纹方向	定义转轴的拧紧方向。	顺时针

软启动

在**软启动**期间，可以设定速度、最大扭矩和旋转角度，以帮助螺钉进入螺纹并且避免在按下工具触发器时工具被猛拉出位置。



参数名称	说明	默认值
软启动	允许设置工具帮助螺钉进入螺纹的速度、角度和最大扭矩。 **关闭：**软启动已关闭。 **开启：**软启动已开启。	开启
速度	定义软启动期间的速度。	35 rpm

参数名称	说明	默认值
角度	定义转轴的旋转角度（便于螺钉进入螺纹中）。	90°
扭矩最大值	定义软启动期间施加的最大扭矩。如果超过了**最大扭矩**，拧紧中止并显示一条错误消息。拧紧操作将被视为不正确。	1.25 Nm

重复拧紧检测

当**重新打击检测**被激活时，可以发现已经拧紧的螺钉。

参数	说明	默认值
重复拧紧检测	检测尝试拧紧已拧紧螺钉的次数。 **早期：**检测到重复拧紧时，立即终止拧紧。拧紧操作将被视为 NOK。要求激活软启动。 **完成：**拧紧不会被终止，直到所有拧紧步骤均已执行完毕。拧紧操作将被视为 NOK。 **关闭：**将不执行重复拧紧检测。	早期

重复拧紧检测 - 早期

利用“重复拧紧检测 - 早期”选项可在检测到重复拧紧时立即终止拧紧，并尽可能以最符合人体工学的方式终止。要使用 **Rehit detection Early**（重复拧紧检测 - 早期）选项，必须将 Soft start（软启动）设置为开启。这是由于 **Soft start torque max**（软启动最大扭矩）值被用作扭矩限值，超出该值的拧紧会被视作重复拧紧并提示重复拧紧错误。

要使用**重复拧紧检测-早期**，“软启动”必须设置为开启。

重复拧紧检测 - 完成

不使用软启动时，要进行重复拧紧检测，必须使用 Rehit detection Complete （重复拧紧检测 - 完成）选项。选择**Rehit detection Complete**（重复拧紧检测 - 完成）将在执行完所有拧紧步骤后终止拧紧，因此所需时间较长。如果速度始终无法达到旋入速度的一半，拧紧将被视为重复拧紧并提示重复拧紧错误。

电流监测

电流监测为监测拧紧扭矩提供额外保护，并且它是工具中的扭矩传感器的补充。

转子电流在最终目标扭矩中被测量并且转换为扭矩值。如果计算的扭矩在测量扭矩的 10% 范围内，那么拧紧被视为 **OK**。

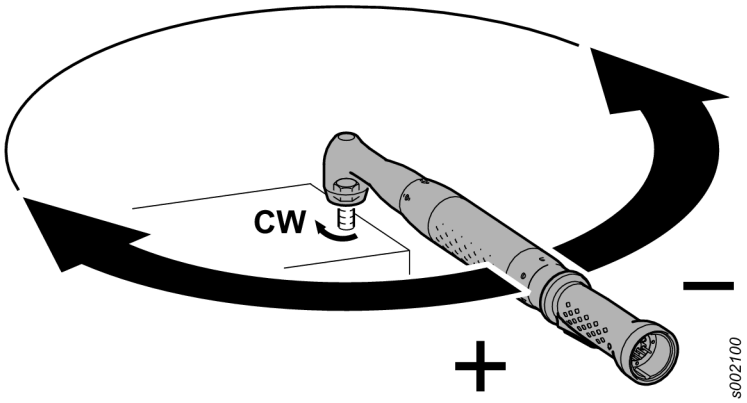
参数	说明	默认
电流监测	具有开 - 关位置的开关 关闭：电流监测被禁用，并且工具扭矩由扭矩传感器测量。 开启：在最终扭矩目标下测量电流并转换为扭矩值。计算的扭矩与测量扭矩对比。如果差异在 10% 以内，那么拧紧被视为 OK	关闭

真实角度补偿

部分工具配备有陀螺仪，并且在拧紧过程中测量工具旋转。如果工具在拧紧过程中旋转，那么角度测量可能会被破坏。如果被制作成角度参考，那么它有可能导致错误的拧紧。对于指定限度内的变化，控制器可以补偿这些旋转并进行正确的拧紧。

如果工具旋转超出了指定的限度，那么拧紧被中止并且报告错误 **NOK**。附加信息报告**工具移动超出限值**。

参数	说明	默认
真实角度补偿	除**旋转**外适用于所有拧紧策略。	开启
角度负限	定义工具的最大逆时针旋转。如果数值超出限度，那么拧紧被终止并且报告错误。以角度数值表示。 ■ 最小值：1 ■ 最大值：180	30
角度正限	定义工具的最大顺时针旋转。如果数值超出限度，那么拧紧被终止并且报告错误。以角度数值表示。 ■ 最小值：1 ■ 最大值：180	30



只有配备陀螺仪的工具才有能力测量工具移动。

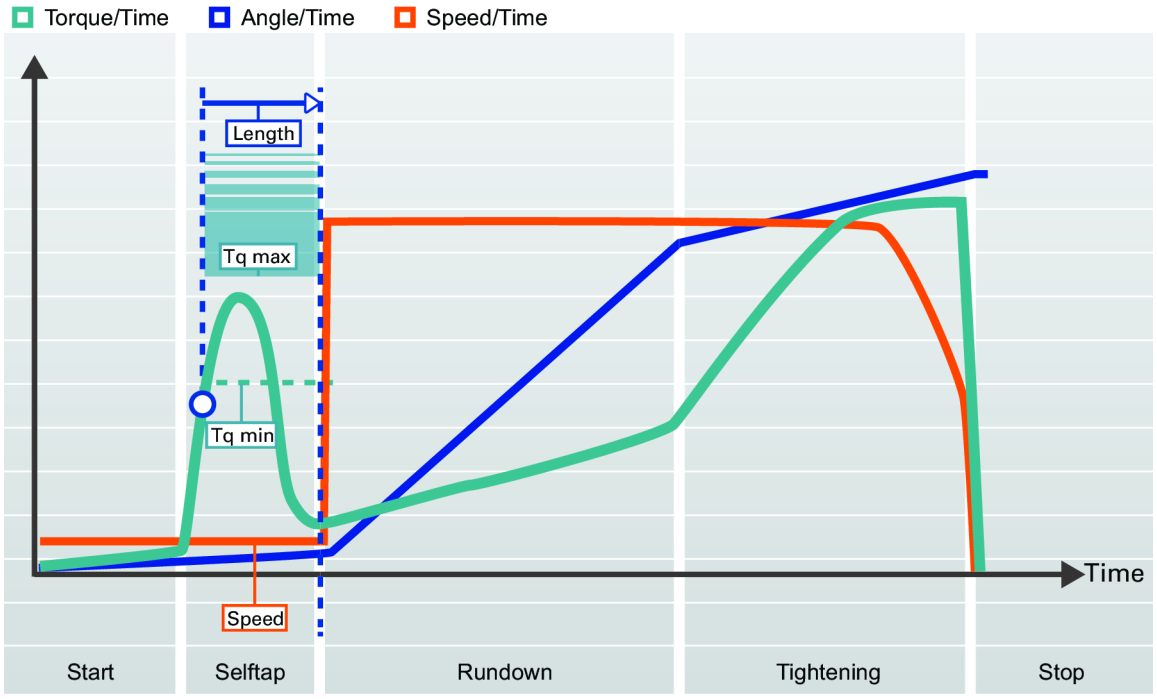
旋入步骤

拧紧的组成部分，该阶段从螺钉进入螺纹时开始，直到螺钉头刚好接触底面并贴合到位为止。旋入期间所需的扭矩不会影响任何夹紧力。

参数	说明	默认值
旋入速度	定义旋入步骤的速度	工具最大速度

自攻

自攻步骤中，可让拧紧的旋入扭矩大于 **Rundown complete**（旋入完成）扭矩，例如，使用自攻螺纹（或自攻）螺栓拧紧金属薄层。当扭矩值达到 SelftapTorqueMin/2 时，自攻窗口启动。在角度窗口中，扭矩必须达到 SelftapTorqueMin 以上，但不超过 Selftap-Torque-Max。

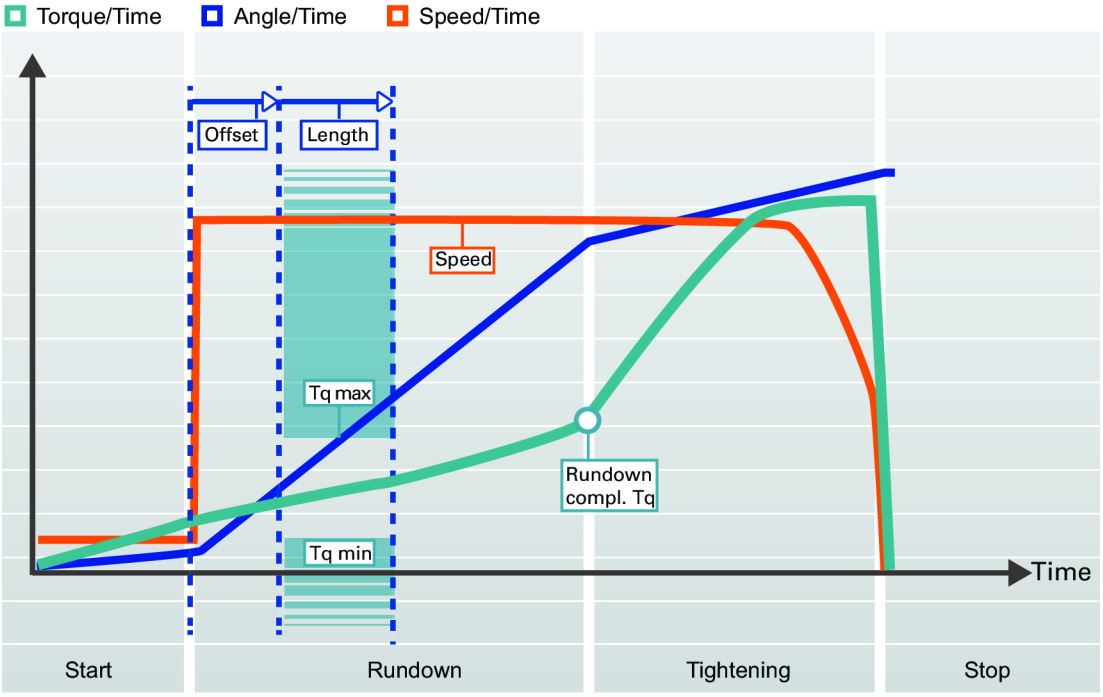


参数	说明	默认值
自攻	激活“自攻”步骤。	关闭
速度	定义自攻期间的速度。	**软启动速度**或**工具最大速度**的 5%
长度	定义自攻期间的套筒旋转角度。从开始步骤结束时开始测量。	360°
最小扭矩	达到自攻下限时的扭矩值。	0 Nm
扭矩最大值	达到自攻上限时的扭矩值。	工具最大扭矩

旋入扭矩限制范围

螺母与连接件之间的摩擦力可能变化。这可能导致拧紧螺母所需的扭矩在螺母与接头表面接合前也发生变化。例如，这些效应可能是孔干涉、预置扭矩或润滑变化。

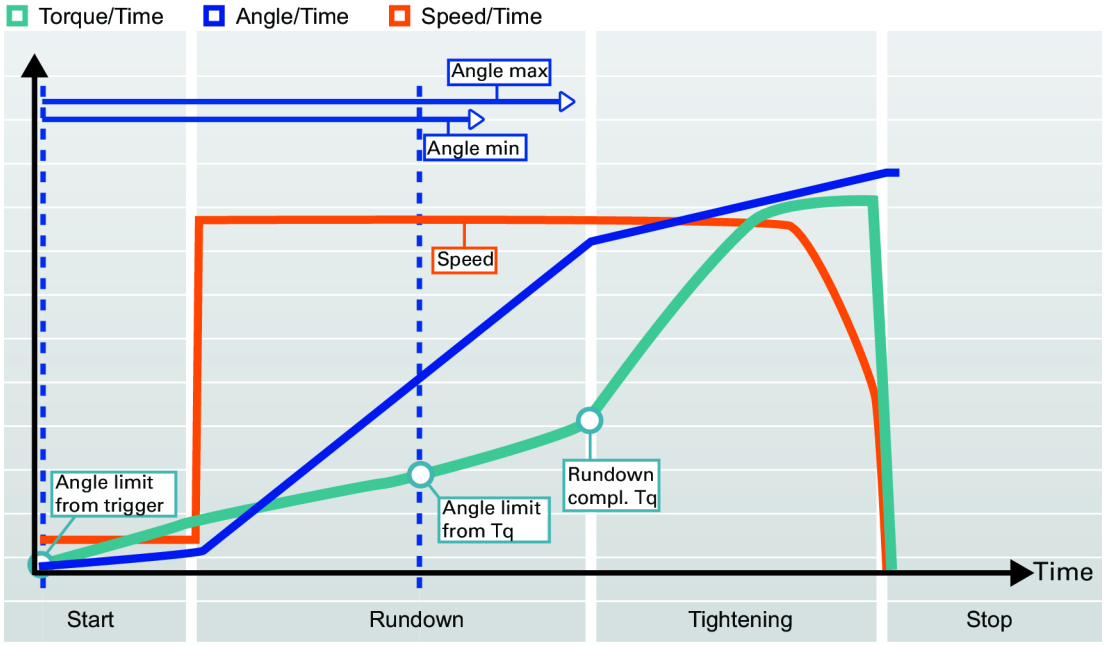
在旋入锁紧螺母（它在螺纹中有一个有助于紧固件抗振的塑料嵌块）时，监控旋入扭矩可能很有用。这将需要更高的扭矩（称为牵出扭矩）来克服干涉。



参数	说明	默认值
旋入扭矩限制范围	将旋入扭矩限值设置为开启或关闭。 **关闭：**没有设置限值。 **开启：**设置扭矩限值和角度间隔。	关闭
偏移	角度间隔开始前的角度偏移。	0°
长度	用以定义旋入扭矩限值部分的角度。	360°
最小扭矩	达到旋入扭矩下限时的扭矩值。	0 Nm
扭矩最大值	达到旋入扭矩上限时的扭矩值。	目标扭矩的 19%

旋入角度限值

通过监控旋入阶段的旋转角度，可以检测到诸如丢失垫片或者使用了螺纹规格或长度不正确的螺钉等错误。例如，螺纹过长可能需要较大的旋转角度，螺钉才可贴合到位。

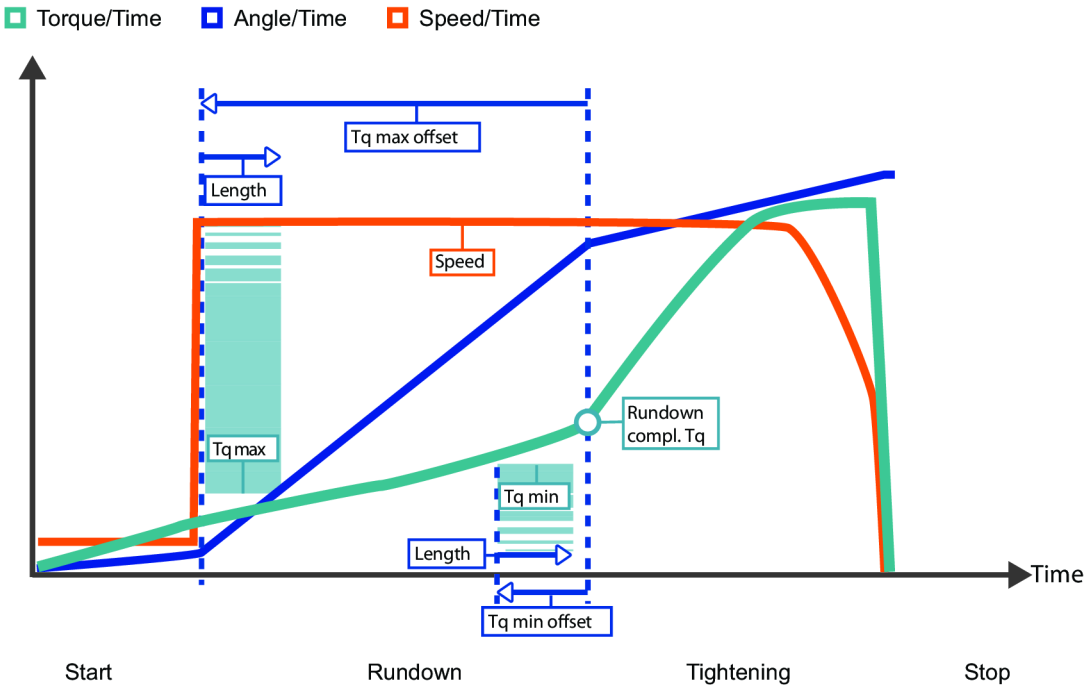


参数	说明	默认值
旋入角度限值	激活旋入角度限值。角度限值设置为按下工具触发器时或达到指定扭矩值时的相应角度。如果激活自攻，则在自攻期间将不会检查角度限值。 **关闭：**没有设置限值。 **从触发器：**旦按下工具触发器，系统便会开始监控拧紧角度，并报告是否超出角度或时间限值。 **从扭矩开始：**系统开始根据指定 **<From torque>**（从扭矩）值监控拧紧角度，并报告是否超出角度或时间限值。	关闭
<From torque>	从设置旋入角度限值的位置开始的扭矩值。	目标扭矩的 10%
最小角度	达到从起点开始的角度下限时的角度值。	100°
最大角度	达到从起点开始的角度上限时的角度值。	1000°
最短时间	该步骤的最短时间（毫秒）。从该步骤开始时进行测量。	10 ms
最长时间	该步骤的最长时间（毫秒）。从该步骤开始时进行测量。	5000 ms

返回查看扭矩

有些连接件在旋入完成前会有一个扭矩峰值。返回查看扭矩可以监控在两个指定角度间隔之间的扭矩值。间隔起始点被定义为旋入完成前的一个角度值，然后就会在指定的角度间隔内监视扭矩值。

因此返回查看扭矩与旋入扭矩限值类似，除非最大和最小限值可以彼此独立定位，并且长度差异能够更好地控制旋入步骤的结果。



参数	说明	默认值
返回查看扭矩	返回查看扭矩可以监控在两个指定角度间隔之间的扭矩值。	关闭
最小扭矩	返回查看扭矩下限扭矩值。	
最小扭矩偏差	返回查看扭矩最小间隔起始前的角度偏差。	720°
最小扭矩长度	角度长度定义了柱状图最小扭矩区域。	90°
扭矩最大值	达到柱状图扭矩上限时的扭矩值。	
最大扭矩偏差	柱状图扭矩最大间隔起始前的角度偏差。	360°
最大扭矩长度	角度长度定义了柱状图扭矩最大值区域。	90°

旋入完成

旋入完成设置螺钉是否已经贴合到位。它结束旋入步骤，以便进入拧紧步骤。

参数	说明	默认值
旋入完成	指定如何控制何时贴合到位。 **贴合扭矩**：指定旋入步骤结束时的扭矩值。	贴合扭矩
<At torque>	定义实现贴合并完成旋入步骤时的扭矩值。旋入完成时的扭矩必须小于多步骤拧紧策略中的**第一扭矩**或者 TurboTight 拧紧策略中的**目标扭矩**。	

拧紧步骤

拧紧步骤将通过一个或多个拧紧步骤对连接件施加夹紧力，具体视选定的策略而定。

拧紧策略

通过选择拧紧策略，可以选择对连接件施加夹紧力（或预载荷）的方法。对于如何施加所需的夹紧力以及如何最大限度地减少不必要的“在使用中”效果，不同的连接件需要有不同的策略。

TurboTight 拧紧策略提供使用“手动编程”或“快速编程”的选项。请参阅 *TurboTight [页次 45]* 一节。

“快速拧紧”、“两步拧紧”和“三步拧紧”策略允许选择拧紧的目标扭矩或目标角度值。请参阅*目标值 [页次 48]* 一节。

四步拧紧策略是一种可配置的策略，它可选择使用全部或仅少数几个可用的步骤。请参阅*四步拧紧策略 [页次 58]* 一节。

当外部数字信号表明 OK 拧紧时使用外部结果策略。请参阅 *外部结果 [页次 47]* 一节

所有拧紧策略都需要您至少设置**目标扭矩**或 **目标角度**值。

参数	说明	默认值
策略	可用的拧紧策略。 **TurboTight**：没有额外拧紧的方式被用作默认方式。仅使用目标值。 **快速拧紧**：添加一个初始拧紧步骤，以减小预载荷分布。 **两步拧紧**：在第一个和最后一个拧紧步骤之间添加暂停来抵消短期松弛效果。 **三步拧紧**：拧紧到定义的第一扭矩值，然后拧松螺钉并立即重新将其拧紧到目标扭矩。 **四步拧紧**：拧紧策略分为四个单独的步骤。可以分别关掉这些步骤。 **扳手 - 生产**：拧紧策略与 ST Wrench 结合使用。 **扳手 - 质量**：策略适用于利用 ST Wrench 进行的拧紧品质测试。 **旋转**：以指定速度和角度转动转轴。 **External result**（外部结果）：显示预定义的拧紧结果，而不是测量的扭矩/角度。 **Multistep**（多步骤）：拧紧策略包括多个配置步骤，及限制和监控。	TurboTight
目标值类型	定义最后一步的目标值类型。 **目标扭矩**：执行最后一步时，拧紧到指定的目标值。 **目标角度**：执行最后一步时，拧紧到指定的目标值。	
目标扭矩	定义最后一步拧紧的目标扭矩。	
目标角度	定义最后一步拧紧的目标角度。	
目标速度	手动设置用于最后步骤的工具速度或者使用默认速度。 **自动**：使用基于 **Tool max speed**（工具最大速度）计算的值。 **手动**： 手动规定工具速度。	自动
<Manual>	拧紧或最终步骤过程中的工具速度。	

TurboTight

TurboTight 是默认的拧紧策略，其设计旨在根据工具的最大速度（Tool max speed）执行一个速度很快且符合人体工学的拧紧操作。该策略有两个选项：

- **Quick prog**（快速编程），该策略只需要设置 **Target torque** （目标扭矩），便可执行拧紧操作。实时监控未激活。
- **Manual**（手动），允许用户配置多个拧紧参数。

在采用 TurboTight 拧紧策略时，为最大限度降低拧紧结束之际意外猛拉造成的风险，须确保启用实时监控功能。

具体取决于连接件特性，例如，如果连接件很硬或很软，则可能需要使用不同于 TurboTight 的拧紧策略。

TurboTight 不适用于连接件控制。

微调 TurboTight 拧紧策略

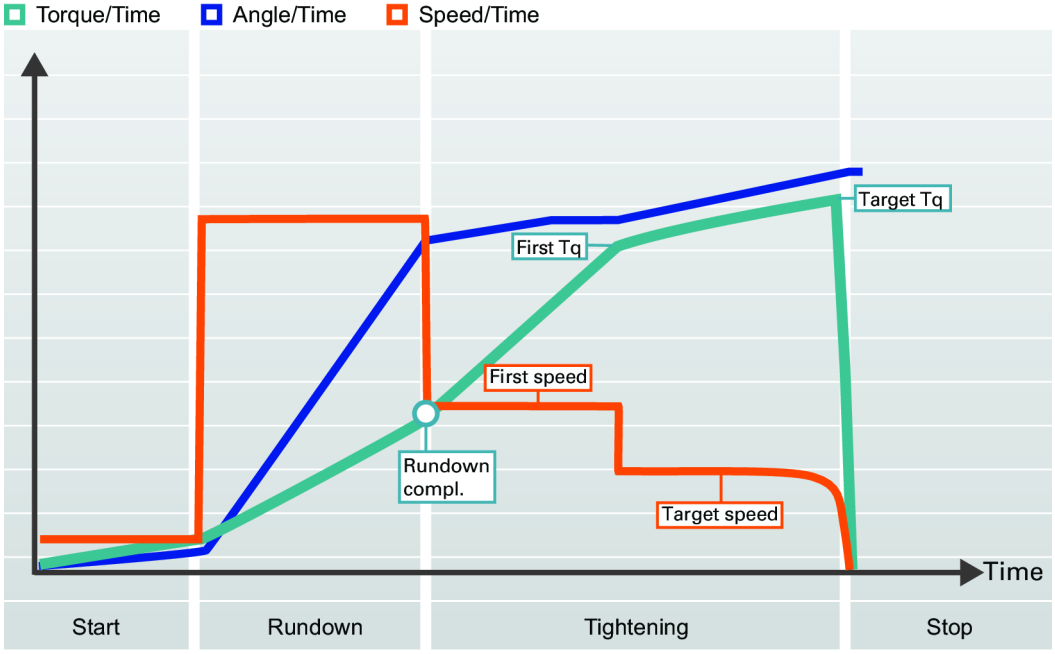
如果 TurboTight 拧紧策略产生了不好的结果，建议查看旋入完成扭矩是如何设置的。旋入完成扭矩设置过高会导致给 TurboTight 拧紧策略在拧紧步骤进行所需计算提供的时间过少，从而造成超过该值。应将旋入完成扭矩设置为尽可能接近贴合的扭矩值。

旋入完成扭矩设置过高还可能导致 TurboTight 拧紧策略没有充足的时间在拧紧步骤进行所需计算，从而导致超过该值。如果连接件非常硬，避免这一点更为重要。

参数 *Time max*（最长时间）与实时监控配合使用，在不停止正常拧紧的情况下，必须尽可能设为较低数值。

快速拧紧步骤

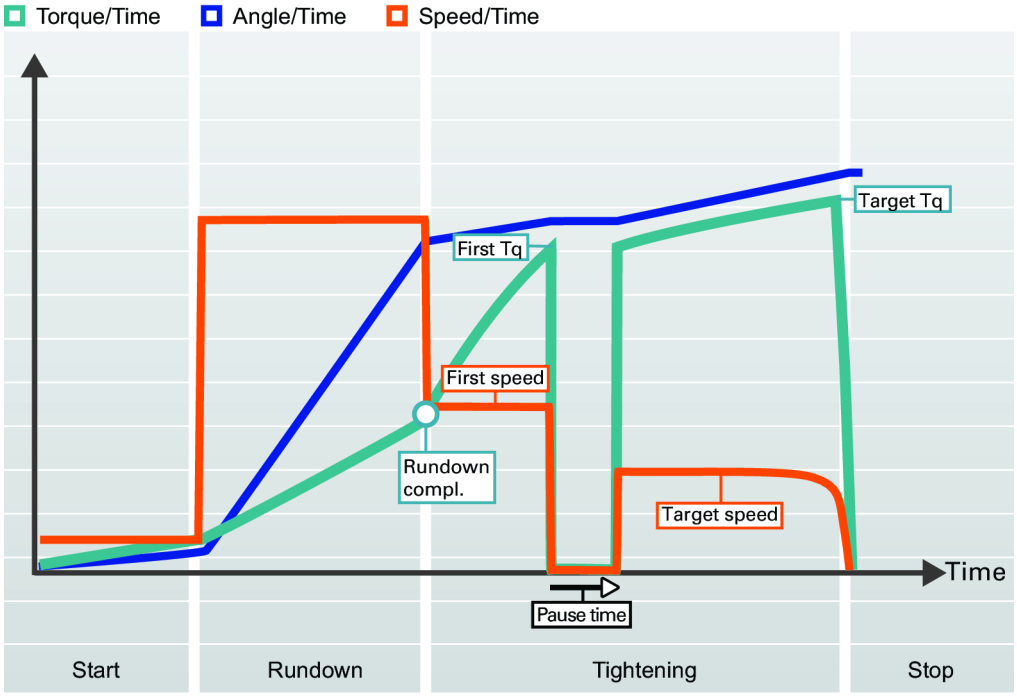
快速拧紧步骤是一种通过添加以给定扭矩和速度进行的初始拧紧步骤，然后在最后阶段降低目标转速，来减少连接件预载荷分布的拧紧策略。



参数	说明	默认值
第一扭矩	第一个拧紧步骤的目标扭矩。	
第一扭矩	第一个拧紧步骤期间的扭矩。	目标扭矩的 80%
第一速度	第一个拧紧步骤的目标速度。	
第一速度	第一个步骤期间的工具速度。	工具最大速度的 50%

两步拧紧

两步拧紧策略与“快速步骤”策略非常相似，只不过前者略微增加了第一步和最后一步之间的时间延迟，用以进一步抵消连接件中的短期松弛效果。



参数	说明	默认值
第一扭矩	第一个拧紧步骤期间的扭矩。	目标扭矩的 80%
第一速度	第一个拧紧步骤的目标速度。	
暂停时间	第一步和第二步之间的时间。	50 ms

微调两步拧紧策略

当达到第一个目标值时，工具立即停止，经过一段规定的时间后，继续进行最后拧紧步骤。应选择第一扭矩值和暂停时间，以便改善手持工具的人体工学。

三步拧紧

三步拧紧策略在第一步和最后一步之间添加了一个拧松步骤，以消除由于嵌入导致的短期松弛，并减少预载荷分布。这有时被用于调节连接件的状况。例如，这在接合件具有许多接合表面时很有用，并且由于新部件表面光滑减少了嵌入，对新部件的作用比旧部件更大。

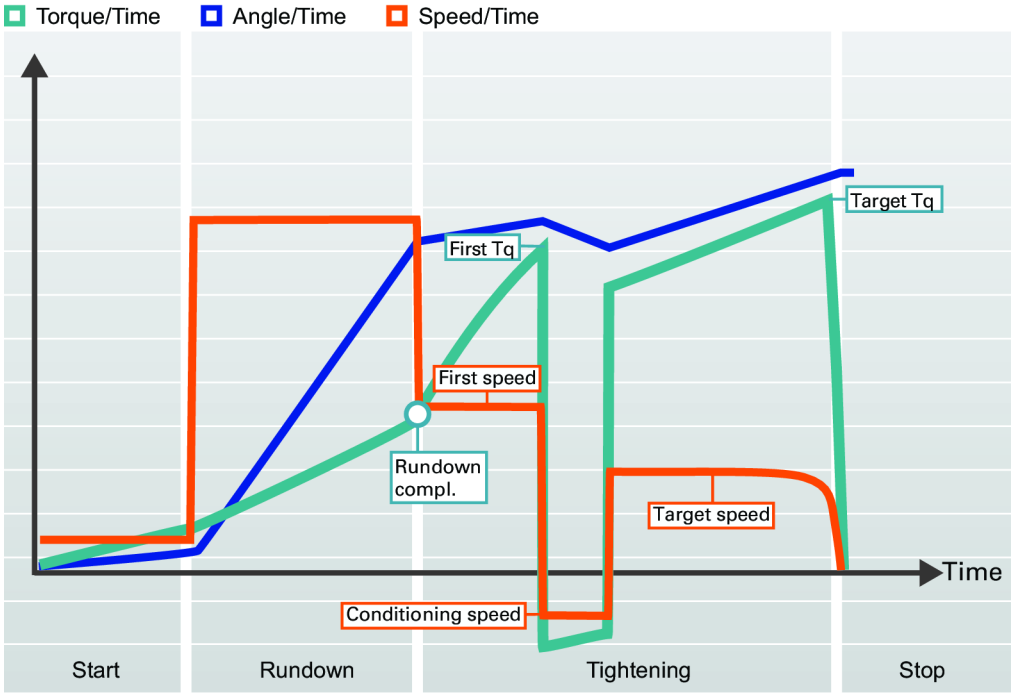
调节连接件是通过以下步骤来完成的：在第一步中拧紧到给定的扭矩（**第一扭矩**），然后通过将螺母旋转一个指定的**调节角度**来释放载荷，最后重新将螺母拧紧到其**目标扭矩**。

在旋入后首个步骤期间，目标扭矩可低于达到的扭矩。要使目标扭矩低于初始扭矩，将目标扭矩（Tightening parameters > Tightening step > Final step > Target torque（拧紧参数 > 拧紧步骤 > 最终步骤 > 目标扭矩））设为低于初始扭矩（Tightening parameters > Tightening step > First step > First torque（拧紧参数 > 拧紧步骤 > 首个步骤 > 初始扭矩））的某个值。

如果在拧紧程序中将角度用作目标值，则可基于结束松开步骤（调整）时的位置测量目标角度。

扭矩测量条件及角度测量条件的特性

在扭矩测量条件和角度测量条件的结果评估栏下测量的 **Max torque value**（最大扭矩值）和 **Value at peak torque**（达到峰值扭矩的值）分别表示整个拧紧过程中测量的最高值。也就是说，如果设定的目标扭矩低于初始扭矩，则结果评估值将高于终值。要查看拧紧最终值，均应将扭矩测量条件和角度测量条件设为切断时的值。



参数	说明	默认值
第一扭矩	第一个拧紧步骤期间的扭矩。	目标扭矩的 80%
第一速度	第一个步骤期间的工具速度。	工具最大速度的 50%
调节速度	调节步骤期间的工具速度。	工具最大速度的 50%
调节角度	调节步骤期间的套筒旋转角度。	180°

微调三步拧紧策略

当达到第一个目标值并输入了调节步骤时，工具在进行最后拧紧步骤前立即停止并反转。这个调节步骤可能需要进行微调，以便改善手持工具的人体工学。

四步拧紧

有关四步拧紧的信息，请参阅“四步拧紧策略”一节。

扳手 - 生产和扳手 - 质量

有关结合 ST Wrench 使用的两种策略之信息，请参阅*ST Wrench [页次 70]*一节。

旋转

旋转策略是一种主要用于测试和演示目的的策略。允许工具空转时，它会使用一个尽可能低的扭矩将套筒旋转指定的角度。

参数	说明	默认值
目标速度	适用于旋转策略的目标速度。	
<Target speed>	旋转策略期间的手动工具速度。	工具最大速度的 16.5%
目标角度	转轴的旋转角度。	360°

外部结果

外部结果是在通过外部数字信号（而非通过拧紧期间测得的扭矩或角度值）显示拧紧完成时使用的策略。外部信号可以通过可向 Power Focus 6000 提供数字信号的任意方式提供（如通过 I/O 总线）。

在发出信号时，结果视图将显示在拧紧程序中提供的目标参数值（规定的扭矩值、角度值或文本字符串）。这些（扭矩和角度）值不代表实际的测量值，而仅是插入的文本。

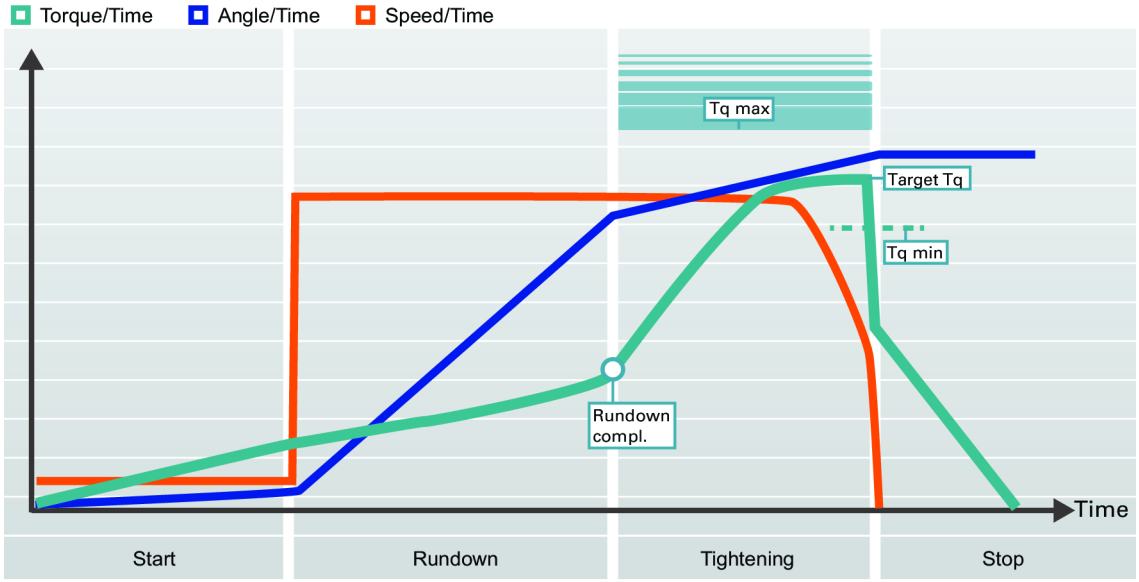
参数	说明	默认值
扭矩 <目标扭矩>	所需显示目标扭矩值的数值	0.00
角度 <目标角度>	所需显示目标角度值的数值	360°
文本	所需显示文本的字母数字字符串。	

多步骤

有关多步骤的信息，请参见“多步骤拧紧策略”一节。

目标扭矩限值

通过设置 **Target torque limits** （目标扭矩限值），如果某次拧紧的扭矩结果超出指定的扭矩限值，则可以废弃该拧紧。扭矩设置过高可能会导致螺钉因传递屈服点而变形，甚至折断，或者导致螺纹脱扣。扭矩不足会导致夹紧力不足以承受连接件的设计所能承受的力。



参数	说明	默认值
扭矩限值	如果扭矩结果超出由最小扭矩和最大扭矩所定义的范围，则拧紧操作被视为 NOK。 **自动：** 扭矩限值会自动设置为指定的最小扭矩和扭矩最大值的默认值。 **手动：** 允许手动设置扭矩限值。	自动
最小扭矩	达到扭矩下限时的扭矩值。如果已选定 **Manual**（手动），则可以输入。	目标扭矩的 95%
扭矩最大值	达到扭矩上限时的扭矩值。如果已选定 **Manual**（手动），则可以输入。	目标扭矩的 120%

参数 **Measure torque at** （不同条件下测量扭矩）可能具有不同的值。默认是在达到扭矩峰值时测量扭矩。下表列出了可能的参数值。

名称	说明
最大扭矩值	在拧紧时测量最高的扭矩值。
达到峰值角度时的值	在达到最高角度值时测量扭矩值。

名称	说明
切断时数值	在进入拐点步骤前测量最后的扭矩值。

目标角度限值

在设置目标角度限值后，可以监控拧紧期间螺母是否旋转了所需的角度。

参数	说明	默认值
角度限制	选择监控角度的拧紧范围（°）。 1. **关闭：**未选中限值。 2. **从旋入完成开始：**监控窗口设置为从达到**旋入完成扭矩**时开始。 3. **从扭矩开始：**监视窗设置为从达到规定扭矩值时开始。扭矩必须大于旋入完成扭矩。 4. **从第一目标值：**设置为达到 **First target**（第一目标值）时开始监控。如果选择 TurboTight，则此选项不可用。 5. **自动：**角度监控限值由控制器自动计算 6. **手动：**角度监测限值手动输入。	关闭
<From torque>	从设置角度限制范围位置开始的扭矩值。	
<From torque>	从设置角度限制范围位置开始的扭矩值。	目标扭矩的 75%
最小角度	达到角度下限时的角度值。	90°
最大角度	达到角度上限时的角度值。	720°
最短时间	该步骤的最短时间（毫秒）。从该步骤开始时进行测量。	10 ms 对于 TurboTight：0 ms
最长时间	该步骤的最长时间（毫秒）。从该步骤开始时进行测量。	1000 ms 对于 TurboTight：40 ms

如果目标值为扭矩，则位置 1-4 有效。如果目标值为角度，则位置 5-6 有效。

参数 **Measure angle at**（角度测量条件）可能具有不同的值。本参数仅适用于为使用的拧紧程序开启角度监控时。默认在达到最大角度时测量此角度。下表列出了可能的参数值。

名称	说明
达到峰值扭矩时的值	在达到最高扭矩值时测量角度。
最大角度值	在拧紧时测量最高角度。
切断时数值	在进入拐点步骤前测量最后的角度值。

扭矩补偿

使用扭矩补偿，能够更好地确定作用在连接件上的实际夹紧力，并且能够减少施加的夹紧力的分散。

通过参照从旋入完成开始时的规定角度以及计算旋入阶段所用的扭矩值设置扭矩补偿点。之后，通过给目标扭矩添加扭矩补偿点计算出的扭矩值以便在螺钉中形成预载荷时，将进行补偿。

参数	说明	默认值
扭矩补偿	允许针对旋入步骤中使用的扭矩调整目标扭矩。 **关闭**：不进行补偿。 **开启**：手动设置扭矩补偿点。	关闭

停止步骤

“停止步骤”将终止拧紧，以松开套筒。

软停止

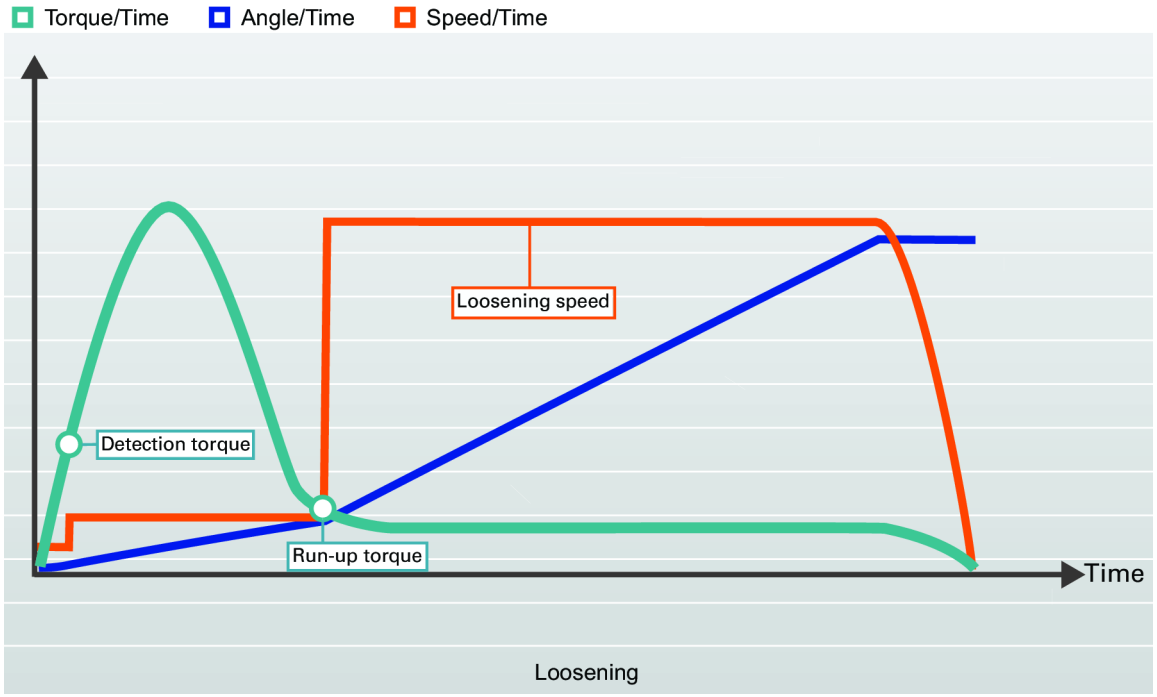
软停止使得拧紧能够以一种更加符合人体工学的方式停止。

参数	说明	默认值
软停止	打开或关闭软停止。 **关闭**：不使用软停止。 **开启**：软停止已激活. 达到目标扭矩后，工具速度立即降到 75%。之后在最多 40 毫秒内，速度降到 0。	关闭

拧松步骤

通过设置拧松参数，可控制指定拧紧程序的拧松行为特性。指定拧松速度和扭矩以确保螺钉按照预期松开，从而确保无论使用哪种工具，螺钉的螺纹都不会受损。

达到**旋出扭矩**后，拧松被视为 OK。但是，此时螺钉很可能尚未被完全旋出。此时的螺钉可使用低扭矩转动并且速度也可增加。操作员需要继续拧松直到视为完成。



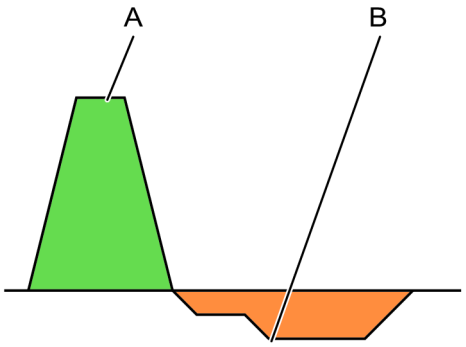
参数名称	说明	默认值
检测扭矩	执行拧松操作并产生拧松结果所需的最小扭矩。	7% 工具最大扭矩
旋出扭矩	扭矩低于**旋出扭矩**时，拧松被视为 OK。 **注意！**由于螺钉长度不同，系统可能无法确定螺钉何时才完全旋出。这由操作员决定。	3.5% 工具最大扭矩
反松速度	达到**旋出扭矩**后，获得拧松速度。	工具最大速度

通过直接驱动型电气工具实现脉冲拧紧

下文原理适用于直接驱动型电气工具。此外，也适用于 Atlas Copco SRB 系列工具。

脉冲拧紧在电机中使用电流脉冲技术，提供以下两种独特功能：

- 作用电流，沿拧紧方向增加正扭矩。
- 反作用电流，通过施加反向扭矩提供舒适的反作用力。



脉冲拧紧原理

A	作用脉冲，施加拧紧作用力。	B	反作用脉冲，保证舒适性

上图表示电流脉冲拧紧策略的一般原理。详细的曲线取决于工具型号和拧紧算法。

脉冲期包括图示的两个阶段，即作用电流和反作用电流。每个作用脉冲负责向拧紧加大扭矩，直至达到最终目标值。每个反作用脉冲形成提供舒适反作用效果的反作用力。

作用阶段和反作用阶段的能级均是可配置的参数。结合使用这两个参数可实现高效的拧紧和操作舒适性。

TensorPulse 拧紧程序

将打开 TensorPulse （脉冲 - 单步）拧紧策略适用于脉冲工具。如果控制器软件版本支持拧紧程序，则可选择此策略。相比持续驱动工具，脉冲工具可保证更高的扭矩。

下表列出了 TensorPulse 拧紧策略的所有参数。一些参数是必需项，一些参数为可选项，一些参数则为条件项。

如果条件无效，不会在配置菜单中显示条件参数，其与对应的功能被禁用。

TensorPulse 参数 开始

在启动步骤中，工具在速度模式下旋转，无需任何脉冲作用。

参数名称	说明	默认值
软启动	允许设置工具帮助螺栓进入螺纹的速度、角度和最大扭矩。 通过单选按钮选择。 **关闭：**软启动已关闭。 **开启：**软启动已开启。	开启
速度	定义软启动期间的速度。	34 rpm
角度	定义转轴使螺栓进入螺纹的目标旋转角度。	90°
扭矩最大值	定义软启动期间施加的扭矩上限。如果超过 **Torque max**（扭矩最大值），则将拧紧视为 NOK。	1.25 Nm
重复拧紧检测	**早期：**在检测到已拧紧的螺钉/螺栓时立即终止拧紧。拧紧操作将被视为 NOK。要求激活**软启动**。 **完成：**即使检测到已拧紧的螺钉/螺栓，只有在执行所有拧紧步骤后，才可终止拧紧。拧紧操作将被视为 NOK。在不使用 **Soft start**（软启动）时，要进行重复拧紧检测，必须选择 **Rehit detection Complete**（重复拧紧检测完成）选项。**Rehit detection Complete**（重复拧紧检测完成）将在执行完所有拧紧步骤后终止拧紧。如果速度始终无法达到旋入速度的一半，拧紧将被视为重复拧紧并提示重复拧紧错误。 **关闭：**将不执行重复拧紧检测。 软启动组合 = 关闭和重复拧紧 = 之前不支持。	早期
正	TrueAngle 补偿可检测工具转动并在设定限值范围内进行角度补偿。	30°
负	TrueAngle 补偿可检测工具转动并在设定限值范围内进行角度补偿。	30°
使用附件调校	附件调校通过单选按钮选择。	
齿轮比	套筒转速 = 工具速度/传动比。	1.0
效率优化	例如，0.9 表示 10% 的效率损失。	1.0

TensorPulse 参数 旋入

在旋入期间，工具可使用电机为恒速的速度模式，也可使用脉冲模式。具体根据配置中使用的扭矩和规定的扭矩限值进行选择。

参数名称	说明	默认值
高速旋入	为了最大程度缩小时间且不超过，可高速实施旋入步骤。这可通过让工具按规定的角度长度高速运转实现。在达到这一角度后，速度可调整为 **Rundown speed**（旋入速度）参数中规定的更低速度。仅适用于 SRB 工具。 **长度：**默认 3600°，最大值 99999° **速度：***Tool max speed*（工具最大速度）必须高于 *Rundown speed*（旋入速度）（rpm）。	
旋入速度	可以将旋入速度设为 **Max**（最大）或 **Manual**（手动）。 如果将旋入速度设为 **Manual**（手动），则输入工具速度（rpm）。	最大
旋入角度限值	**关闭：**旋入角度限值关闭。 **从触发器：**旋入角度限值**开启**。一旦按下工具触发器，系统便会开始监控拧紧角度，并报告是否超出角度限值。 **从扭矩开始：**旋入角度限值**开启**。系统开始根据指定的扭矩值监控拧紧角度，并报告是否超出角度限值。	关闭
旋入角度监测扭矩	从设置**旋入角度限值**的位置开始的扭矩值。	
最小角度	达到从起点开始的角度下限时的角度值。	100°
最大角度	达到从起点开始的角度上限时的角度值。	1000°

参数名称	说明	默认值
最短时间	步骤的最短时间。	10 ms
最长时间	步骤的最长时间。	5000 ms
旋入脉冲限值	通过快捷菜单选择： **关闭：** 旋入脉冲限值关闭。 **从触发器：** 旋入脉冲限值 **On**（开启）。一旦按下工具触发器，系统便会开始监控脉冲并报告是否超出脉冲限值。 **从扭矩开始：** 旋入脉冲限值 **On**（开启）。系统开始根据指定的扭矩值监控脉冲，并报告是否超出脉冲限值。	关闭
旋入脉冲监控扭矩	从**旋入脉冲限值**监控器启动时开始的扭矩值。此值须设定为大于 *Continuous max torque*（最大持续扭矩）的某个值。	2.5 Nm
脉冲最小值	达到 *Rundown complete torque*（旋入完成扭矩）值的最小脉冲数。	2
脉冲最大值	达到 *Rundown complete torque*（旋入完成扭矩）值的最大脉冲数。	50
旋入完成扭矩	定义实现贴合并完成旋入时的扭矩值。如果在旋入期间尚未完成操作，程序将继续进行拧紧并启动脉冲模式。	5 Nm

TensorPulse 参数 拧紧

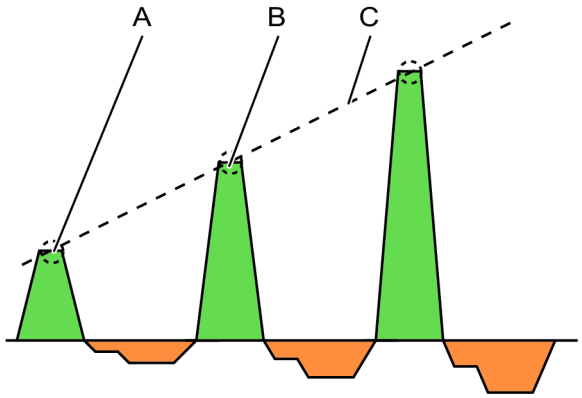
参数名称	说明	默认值
目标扭矩	拧紧的最终目标扭矩。	
脉冲能量	工具可以在每个脉冲中提供的 *Pulse energy*（脉冲能量）， 在以最大能量百分比形式表示的作用脉冲中提供。	80%
反作用力系数	工具提供的能量以百分比值形式表示。*reaction force retention factor*（反作用力保持系数）以作用能量为基础，提供舒适的反作用力。	25%
剩余扭矩校正系数	剩余扭矩校正系数这一术语类似于校准，用于调整电气工具测量的动态扭矩和控制工具测量的剩余扭矩。	100%
扭矩限值	可以 **Automatically**（自动）或 **Manually**（手动）选择限值。	
最小扭矩	步骤的最小扭矩。	
扭矩最大值	步骤的最大扭矩。	
角度限制	**Off:**（关闭：）**Angle limits**（角度限值）关闭。 **从旋入完成开始：Angle limits** （角度限值） **On**（开启）。在达到 *Rundown complete*（旋入完成）后，系统便会开始监控拧紧角度并报告是否超出角度限值。 **从扭矩开始：旋入角度限值开启**。系统开始根据指定的扭矩值监控拧紧角度，并报告是否超出角度限值。	关闭
旋入角度监测扭矩	从 **旋入角度限值**监控启动时开始的扭矩值。	
最小角度	达到从起始点开始的角度下限时的角度值。	100°
最大角度	达到从起始点开始的角度上限时的角度值。	1000°
最短时间	步骤的最短时间。	10 ms
最长时间	步骤的最长时间。	5000 ms
脉冲限值	**关闭：**无脉冲限值监控。 **从旋入完成开始：**在达到 **Rundown complete torque**（旋入完成扭矩）时开始监控。 **从扭矩开始：**在达到规定的扭矩值时开始监控。	关闭
最终脉冲监控扭矩	从监控脉冲限值时开始的扭矩值。	
脉冲最小值	达到最终目标值的最小脉冲数。	
脉冲最大值	达到最终目标值的最大脉冲数。	

参数名称	说明	默认值
早期扭矩丢失检测时间	假设在从旋入到拧紧时扭矩持续增加。套筒滑脱或螺钉头损坏会使扭矩下降。在监控窗口可以发现上述状况。	200 毫秒

使用 TensorPulse 程序拧紧

下文原理适用于直接驱动型电气工具。此外，也适用于 Atlas Copco SRB 系列工具。

在每个脉冲期后，产生的螺钉扭矩随之增大。在经历系列脉冲后，达到最终扭矩目标值。

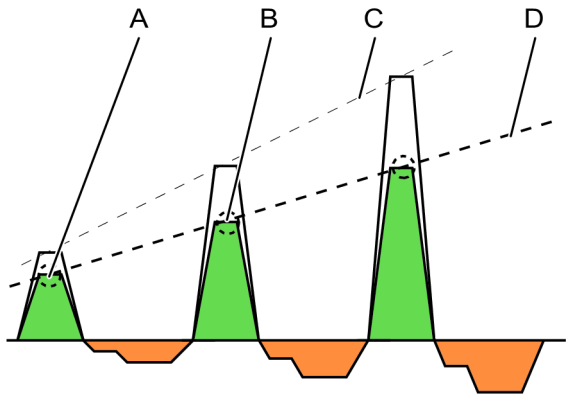


具有最大脉冲能量的 TensorPulse

A	脉冲 N 中的最大正能量	B	脉冲 N+1 中的最大正能量
C	能量（扭矩）增大		

作用阶段和反作用阶段的能级均是用户可配置的参数。结合使用这两个参数可实现高效的拧紧和操作舒适性。在两个阶段可以最大能量百分比的形式设定在各时期提供的能量大小：

- *Pulse energy*（脉冲能量）；在脉冲期可以施加的能量大小，其以最大能量百分比的形式施加到各正脉冲。数值介于 10-100%。
- *Reaction force retention factor*（反作用力保持系数）；在脉冲期可以施加的能量大小，其以最大能量百分比的形式施加到各反作用脉冲。数值介于 0-75%。



具有较低正脉冲能量的 TensorPulse

A	脉冲 N 中的较低正能量	B	脉冲 N+1 中的较低正能量
C	使用最大脉冲能量产生的扭矩形成曲线。	D	使用较低脉冲能量产生的扭矩形成曲线。

- 小的 **Pulse energy**（脉冲能量）（较低能量）要求更多脉冲来达到目标扭矩，因为在更少步骤中增加扭矩。更少步骤提供更高的精准度，以在达到目标值时终止拧紧。较小脉冲可减少工具移动并提高操作舒适性。
- 经正确调校的 *Reaction force retention factor*（反作用力保持系数）将带来最佳的操作舒适性。如果系数过高，操作员会感觉工具以顺时针转动。如果系数过低，操作员会感觉工具以逆时针转动。
- 在理想的配置中，反作用能量不会产生拧松力。如果达到目标值的脉冲量增大，表明数值设定过高并在各脉冲发生轻微拧松。

需调校*脉冲能量*和*反作用力保持系数*的优化值，使工具达到最佳性能和极佳操作舒适性。

脉冲单步拧紧程序

将打开 **脉冲 - 单步** （脉冲 - 单步）拧紧策略适用于脉冲工具。如果控制器软件版本支持拧紧程序，则可选择此策略。相比常规转动工具，脉冲工具可保证更高的扭矩。

下表列出了 **脉冲 - 单步** 拧紧策略的所有参数。一些参数是必需项，一些参数为可选项，一些参数则为条件项。

如果条件无效，不会在配置菜单中显示条件参数，其与对应的功能被禁用。

脉冲 - 单步 开始参数

在启动步骤中，工具在速度模式下旋转，无需任何脉冲作用。

参数名称	条件	说明	默认值
软启动		启用工具速度的设置，方便螺栓进入螺纹。 通过单选按钮选择。 **关闭**：软启动已关闭。 **开启**：软启动已开启。	开启
速度	软启动 = On	定义软启动期间的速度。	300rpm
时间	软启动 = On	定义*软启动*的持续时间。	400ms
重复拧紧检测		通过快捷菜单选择： 检测尝试拧紧已拧紧螺栓的次数. **完成**：拧紧不会被终止，直到所有拧紧步骤均已执行完毕。拧紧操作将被视为 NOK。 **关闭**：将不执行重复拧紧检测。	早期
使用附件调校	在*Properties*（特性）菜单中启用**附件调校**	附件调校通过单选按钮选择。	
齿轮比	*使用附件调校* = Yes	套筒转速 = 工具速度/传动比。	1.0
效率优化	*使用附件调校* = Yes	例如，0.9 表示 10% 的效率损失。	1.0

***脉冲 - 单步** 开始*

脉冲 - 单步 旋入参数

参数名称	条件	说明	默认值
旋入速度		通过单选按钮选择。 可以在**Max**（最大）或**Manual**（手动）间选择旋入速度。	最大
旋入速度	旋入速度 = 手动	规定旋入步骤期间的工具速度。	

参数名称	条件	说明	默认值
旋入时间限值		通过快捷菜单选择： **Off:**（关闭：）**Rundown time limits**（旋入时间限值）关闭。 **从触发器：Rundown time limits**（旋入时间限值）**On**（开启）。一旦按下工具触发器，系统便会开始监控时间并报告是否超出时间限值。 **从扭矩开始：Rundown time limits**（旋入时间限值）**On**（开启）。系统开始根据指定的扭矩值监控时间，并报告是否超出时间限值。	关闭
旋入时间监控扭矩	旋入时间限值 = 从扭矩开始	从 **旋入时间限值**监控启动时开始的扭矩值。	
最短时间	旋入时间限值 = 开启	允许的最小旋入时间。	10ms
最长时间	旋入时间限值 = 开启	允许的最大旋入时间。	5000ms
旋入脉冲限值		通过快捷菜单选择： **Off:**（关闭：）**Rundown pulse limits**（旋入脉冲限值）关闭。 **从触发器：Rundown pulse limits**（旋入脉冲限值）**On**（开启）。一旦按下工具触发器，系统便会开始监控脉冲并报告是否超出脉冲限值。 **从扭矩开始：Rundown pulse limits**（旋入脉冲限值）**On**（开启）。系统开始根据指定的扭矩值监控脉冲，并报告是否超出脉冲限值。	关闭
旋入脉冲监控扭矩	旋入脉冲限值 = 从扭矩开始	从**旋入脉冲限值**监控器启动时开始的扭矩值。	2.5Nm
脉冲最小值	旋入脉冲限值 = 开启	达到目标值的最小脉冲数	2
脉冲最大值	旋入脉冲限值 = 开启	达到目标值的最大脉冲数	50
旋入完成扭矩		定义实现贴合并完成旋入时的扭矩值。	5Nm

脉冲 - 单步 旋入参数

参数名称	条件	说明	默认值
目标扭矩		拧紧的最终目标扭矩。	
脉冲能量		工具可以在每个脉冲中提供的 *Pulse energy*（脉冲能量）， 在以最大能量百分比形式表示的作用脉冲中提供。	
剩余扭矩校正系数		剩余扭矩校正系数这一术语类似于校准，用于调整电气工具测量的动态扭矩和控制工具测量的剩余扭矩。	100%
扭矩限值		通过单选按钮选择。 可以**Automatically**（自动）或**Manually**（手动）选择限值	
最小扭矩	扭矩限值 = 手动	步骤的最小扭矩。	
扭矩最大值	扭矩限值 = 手动	步骤的最大扭矩。	

参数名称	条件	说明	默认值
时间限值		通过快捷菜单选择： **Off:**（关闭：）**Time limits**（时间限值）关闭。 **从旋入完成开始：Time limits**（时间限值）**On.**（开启）。在达到 *rundown complete*（旋入完成）后，系统便会开始监控时间并报告是否超出时间限值。 **从扭矩开始：Time limits**（时间限值）**On.**（开启）。系统开始根据指定的扭矩值监控时间，并报告是否超出时间限值。	关闭
时间监控扭矩	时间限值 = 从扭矩开始	从**时间限值**监控启动时开始的扭矩值。	
最短时间	时间限值 = 开启	允许的最小拧紧时间。	10ms
最长时间	时间限值 = 开启	允许的最大拧紧时间。	1000ms
脉冲限值		通过快捷菜单选择： **关闭：**无脉冲限值监控。 **从旋入完成开始：**在达到 **Rundown complete torque**（旋入完成扭矩）时开始监控并报告脉冲数是否超出限值。 **从扭矩开始：**在达到规定的扭矩值时开始监控并报告脉冲数是否超出限值。	关闭
最终脉冲监控扭矩	脉冲限值 = 从扭矩开始	从监控脉冲限值时开始的扭矩值。	
脉冲最小值	脉冲限值 = 开启	达到最终目标值的最小脉冲数。	2
脉冲最大值	脉冲限值 = 开启	达到最终目标值的最大脉冲数。	50
早期扭矩丢失检测时间		假设在从旋入到拧紧时扭矩持续增加。套筒滑脱或螺钉头损坏会使扭矩下降。在监控窗口可以发现上述状况。	200 毫秒

脉冲 - 单步*拧紧参数*

四步拧紧策略

四步拧紧策略简介

⚠ 警告 存在受伤风险

对拧紧程序配置的更改可能使扭矩、转动方向或拧紧程序目前正使用系统的速度出现异常。这可能导致严重的身体伤害和/或财产损失。

- ▸ 在添加新程序或将更改运用到当前程序中后，请检查拧紧程序配置。

四步拧紧策略分为单独的阶段，可以切换为**开启**或**关闭**，以定制拧紧任务。

每个步骤都具有目标值并且可以监控其他值并按如下划分：

步骤	功能
启动	开始步骤用于接合螺纹并且发现拧紧是否已发生。
旋入	旋入步骤用于将螺钉旋入到贴合位置。
拧紧	拧紧步骤用于将螺钉拧紧到规定的扭矩水平，并且可分为若干步骤。最终目标值可以是目标扭矩或目标角度。
“Stop”（停止）	停止步骤用于以人体工学的方式结束拧紧。

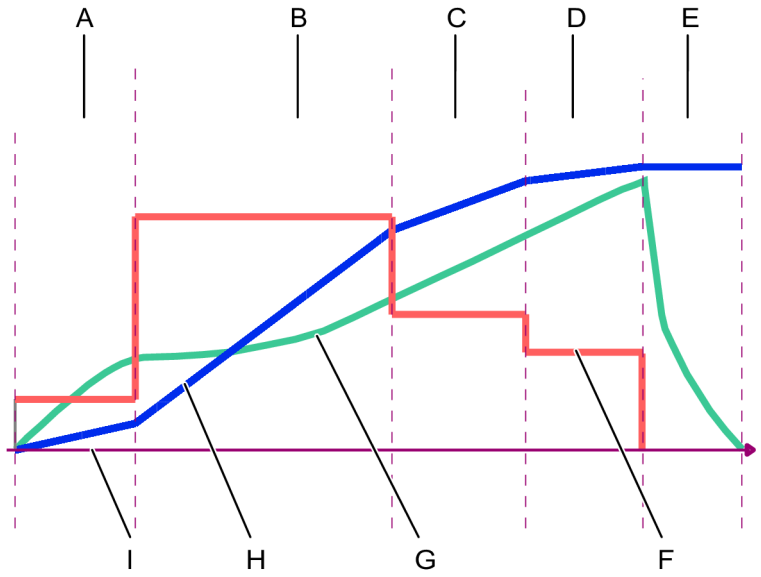
示例 1：如果开始和旋入步骤用于将螺钉拧紧到贴合状态，那么最终拧紧可以在稍后步骤实现。

示例 2：如果拧紧步骤在之前的贴合水平拧紧中使用，则可以进行最终装配来将连接件拧紧到最终目标值。

四步拧紧策略概述

不同步骤的图形表示以及一段时间内的速度、扭矩和旋转角度曲线。

本文采用图形表示，以描述配置设定及参数值的含义。任何 GUI 并未使用图形。



四步拧紧策略

A	**Start**（开始）步骤	B	**Rundown**（旋入）步骤
C	**Tightening**（拧紧）步骤的第一步	D	**Tightening**（拧紧）步骤的最终步
E	**Stop** （停止）步骤	F	速度对时间曲线
G	扭矩对时间曲线	H	角度对时间曲线
I	时间方向		

每个步骤都在扭矩、角度、时间和工具速度方面予以配置。每个步骤都拥有扭矩或角度的目标值，并且监测其他值。

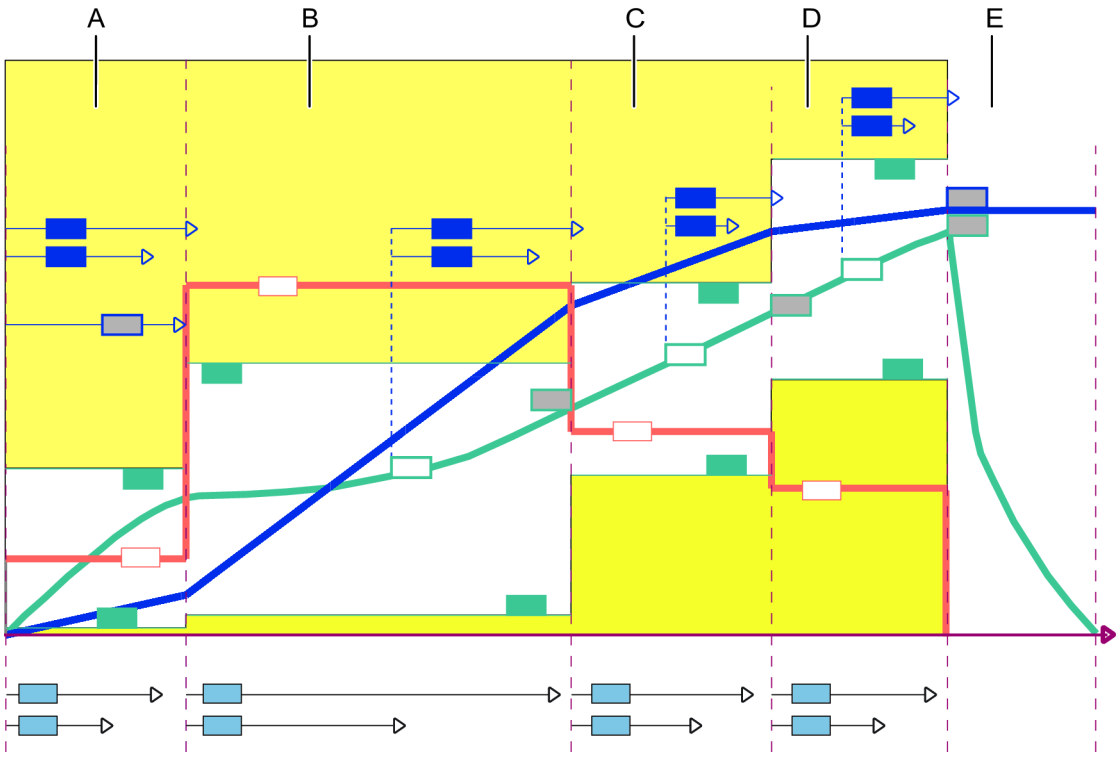
不同步骤及其目标值分别为：

步骤	功能
启动	**目标 = 角度** 本步骤用于接合螺纹并且发现拧紧是否已发生。 时间、角度和扭矩限值可以被监控。
旋入	**目标 = 扭矩** 该步骤采用规定的扭矩值将螺钉或螺母旋入贴合水平。 时间、角度和扭矩限值可以被监控。
拧紧	拧紧步骤分为两个步骤：**first tightening**（最初拧紧）和 **final tightening**（最终拧紧）。 **最初拧紧目标 = 扭矩**。该步骤用于将螺钉或螺母拧紧到规定的最初目标扭矩水平。 **最终拧紧目标 = 角度或扭矩。**该步骤用于从最初拧紧目标继续拧紧到最终目标角度或更大的最终目标扭矩。 时间、角度和扭矩限值可以被监控。
“Stop”（停止）	“停止步骤”将终止拧紧，以松开套筒。

参数定义

不同的参数控制着四步拧紧。为阐明参数及其位置，它们综合显示于速度对时间、角度对时间和扭矩对时间曲线中。

本文采用图形表示，以描述配置设定及参数值的含义。任何 GUI 并未使用图形。



四步拧紧策略 – 所有参数

A 开始阶段 B 旋入阶段

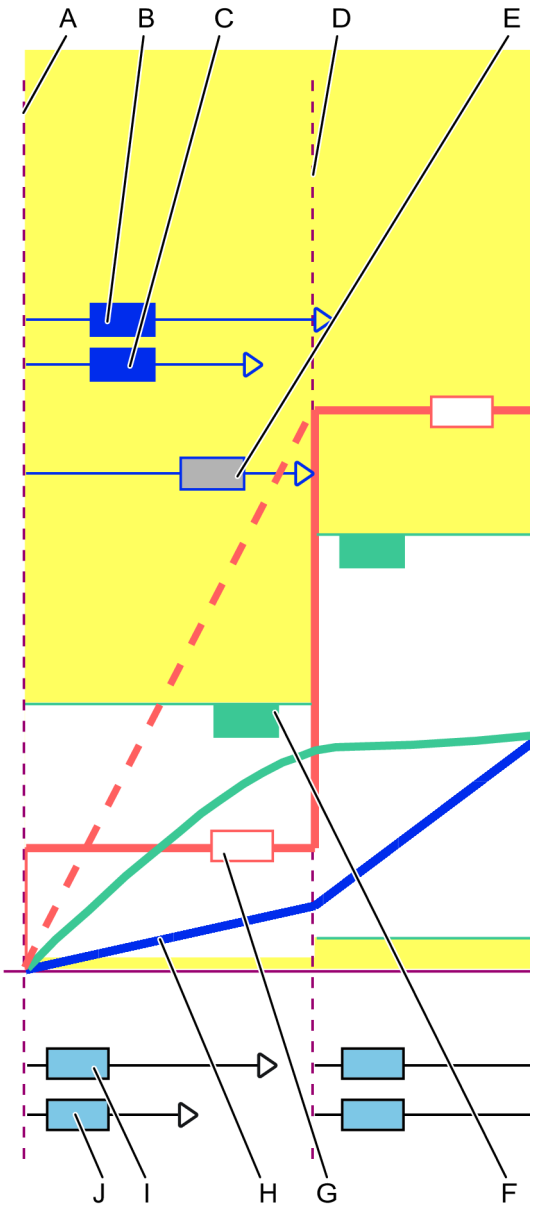
C	拧紧阶段：最初步骤	D	拧紧阶段：最终步骤
E	停止阶段		

四步拧紧参数 — 开始步骤

软启动实现以较慢速度的平稳启动。它可用于接合螺纹。在开始步骤监控时间、扭矩和角度。本步骤有一个角度为目标。

本文采用图形表示，以描述配置设定及参数值的含义。任何 GUI 并未使用图形。

该步骤定义为从触发器按下直到达到指定的目标角度。



四步拧紧 - 最初步骤中的参数

A	按下触发器	B	最大角度（监测）
C	最小角度（监测）	D	开始步骤结束
E	开始步骤目标角度	F	扭矩最大值（监测）
G	速度曲线	H	角度曲线

I	最长时间（监测）	J	最短时间（监测）

本表列出各种可用的参数。仅提供部分参数，如果启用某项功能，则可以查看。

参数	说明	默认值
方向	拧紧的旋转方向。从下拉菜单中选择。 CW：顺时针 CCW：逆时针	顺时针
电流监测	处于**开**或**关**位置的开关。 关：电流监测被禁用，并且工具扭矩由扭矩传感器测量。 开：电流在最终扭矩目标中被测量并且转换为扭矩值。计算的扭矩与测量扭矩对比。如果差异在 10% 以内，那么拧紧被视为 OK	开启
真实角度补偿	处于**开**或**关**位置的开关。	开启
软启动	处于**开**或**关**位置的开关。 如果开关处于**Off**位置，工具转速会尽快上升至旋入速度。	开启

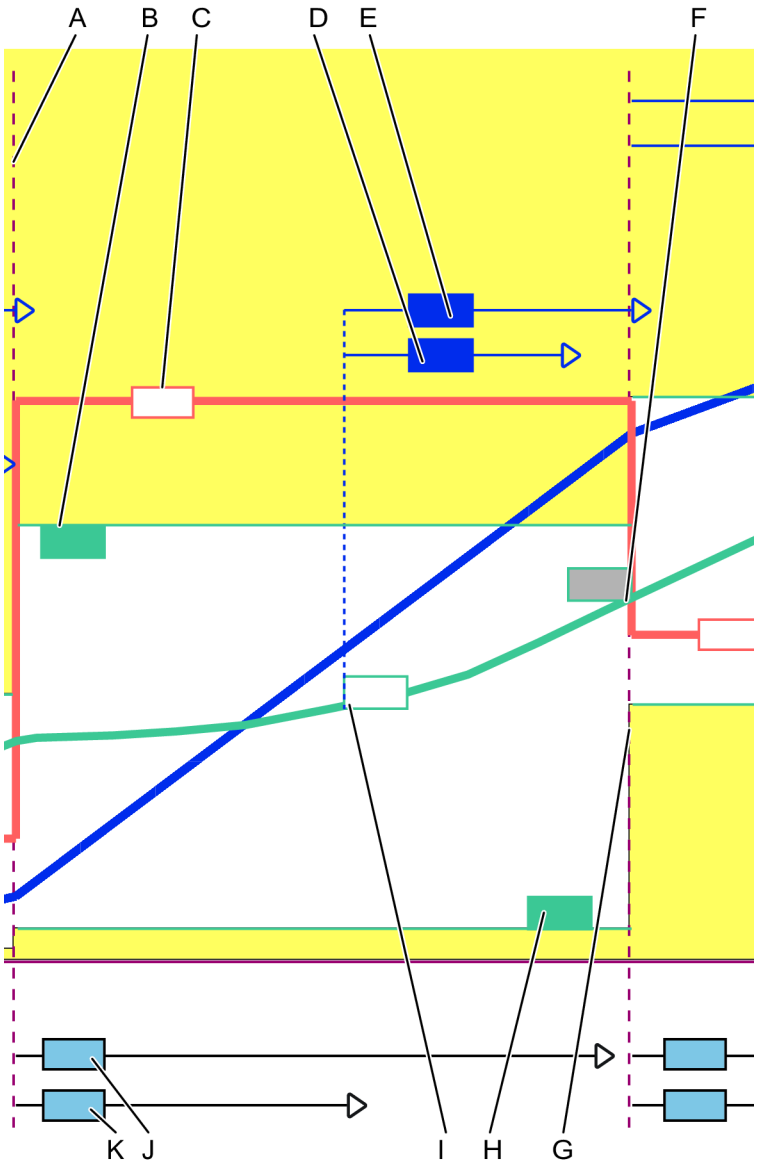
*通过**一般设置**菜单控制的参数*

参数	说明	默认值
速度	步骤内的转轴旋转速度。以数值 rpm 表示。	34 rpm
角度	步骤目标角度。 当目标实现时，步骤结束被定义在此点。	90 度
最小角度	步骤最小转轴旋转。从触发器按下开始测量。以度数数值表示。	70 度
最大角度	步骤最大转轴旋转。从触发器按下开始测量。以度数数值表示。	110 度
最小扭矩	步骤内的最小扭矩值。以数字扭矩值表示	0 Nm
扭矩最大值	步骤内的最大扭矩值。以数字扭矩值表示	1.25 Nm
时间 分钟	步骤最短时间。从按下触发器开始测量。以数字毫秒值表示。	100 毫秒
最长时间	步骤最长时间。从按下触发器开始测量。以数字毫秒值表示。	500 毫秒
负	只有在**真角度补偿 = On**时才可见。 定义工具的最大逆时针旋转。如果数值超出限度，那么拧紧被终止并且报告错误。以角度数值表示。	启用，数值设为 30 度
正	只有在**真角度补偿 = On**时才可见。 定义工具的最大顺时针旋转。如果数值超出限度，那么拧紧被终止并且报告错误。以角度数值表示。	启用，数值设为 30 度

四步拧紧参数 — 旋入步骤

旋入步骤从螺纹接入开始，直至螺钉头实现贴合状态结束。在旋入过程中，时间、扭矩和角度都被监测。步骤目标值是当**旋入完成扭矩**水平已达到时的数值。

本文采用图形表示，以描述配置设定及参数值的含义。任何 GUI 并未使用图形。



四步拧紧 - 旋入步骤中的参数

A	**旋入**步骤开始	B	最大扭矩水平（监测）
C	速度曲线	D	最小角度（监测）；从**旋入角度监测扭矩**开始测量
E	最大角度（监测）；从**旋入角度监测扭矩**开始测量	F	旋入完成扭矩值
G	旋入步骤在目标值被实现时结束	H	最小扭矩水平（监测）
I	扭矩曲线和**旋入角度监测扭矩**参考点	J	最长时间（监测）
K	最短时间（监测）	L	

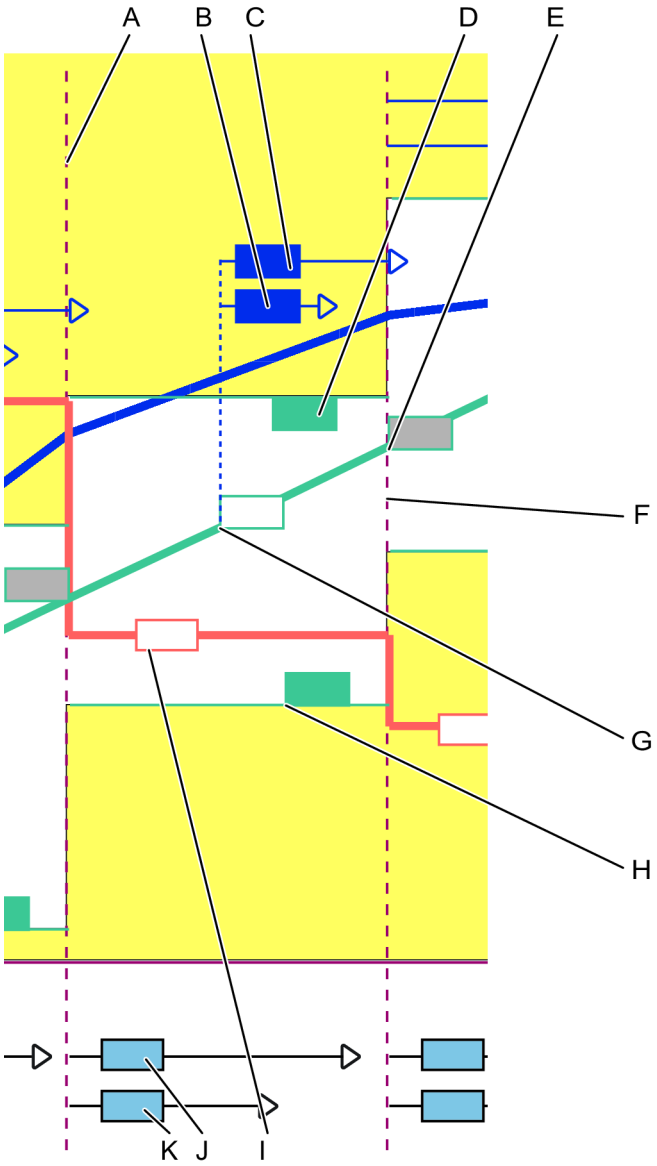
参数	说明	默认值
旋入	处于**开**或**关**位置的开关。 如果开关处于**关**位置，那么此步骤不会被执行，并且其他全部参数都是不可见并被忽视的。 如果开始步骤和旋入步骤都被关闭，那么最终拧紧可以作为单独任何执行。	开启

参数	说明	默认值
旋入速度	处于**手动**或**最大**位置的开关。 如果开关位于**最大**位置，则速度设定为全工具能力。 如果开关位于**手动**位置，则速度将手动设定。	最大
旋入速度（参数输入框）	本参数输入框仅在**手动**速度设置已选定时可见。 步骤内的转轴旋转速度。以数值 rpm 表示。	690 rpm
最小扭矩（监测）	步骤内的最小扭矩值。以数字扭矩值表示	0 Nm
最大扭矩（监测）	步骤内的最大扭矩值。以数字扭矩值表示	6 Nm
旋入角度监测扭矩	指定的扭矩值。从这一时间点开始角度监测。	0 Nm
最小角度（监测）	步骤最小转轴旋转。从**旋入角度监测扭矩**开始测量。以度数数值表示。	100 度
最大角度（监测）	步骤最大转轴旋转。从**旋入角度监测扭矩**开始测量。以度数数值表示。	5000 度
最短时间（监测）	步骤最短时间。从步骤开始时开始测量。以毫秒数值表示。	10 毫秒
最长时间（监测）	该步骤的最长时间。从该步骤开始时进行测量。以数字毫秒值表示。	5000 毫秒
旋入完成扭矩	针对旋入步骤规定目标扭矩。 当达到目标值时，定义步骤结束。	5 Nm

四步拧紧参数 — 拧紧步骤的最初拧紧步骤

拧紧步骤分为两个步骤，第一步和最终步骤。**最初拧紧**步骤从旋入完成开始，直至达到**最初扭矩** 目标水平时结束。在最初拧紧过程中，时间、扭矩和角度都被监测。

本文采用图形表示，以描述配置设定及参数值的含义。任何 GUI 并未使用图形。



四步拧紧 - 拧紧步骤最初步骤中的参数

A	开始拧紧步骤中**最初拧紧**步骤	B	最小角度（监测）；从**最初角度监控扭矩**开始测量
C	最大角度（监测）；从**最初角度监控扭矩**开始测量	D	最大扭矩水平（监测）
E	最初拧紧扭矩值；规定了目标值和步骤结束	F	步骤结束
G	扭矩曲线和**最初角度监测扭矩**参考点	H	最小扭矩（监测）
I	速度曲线	J	最长时间（监测）
K	最短时间（监测）		

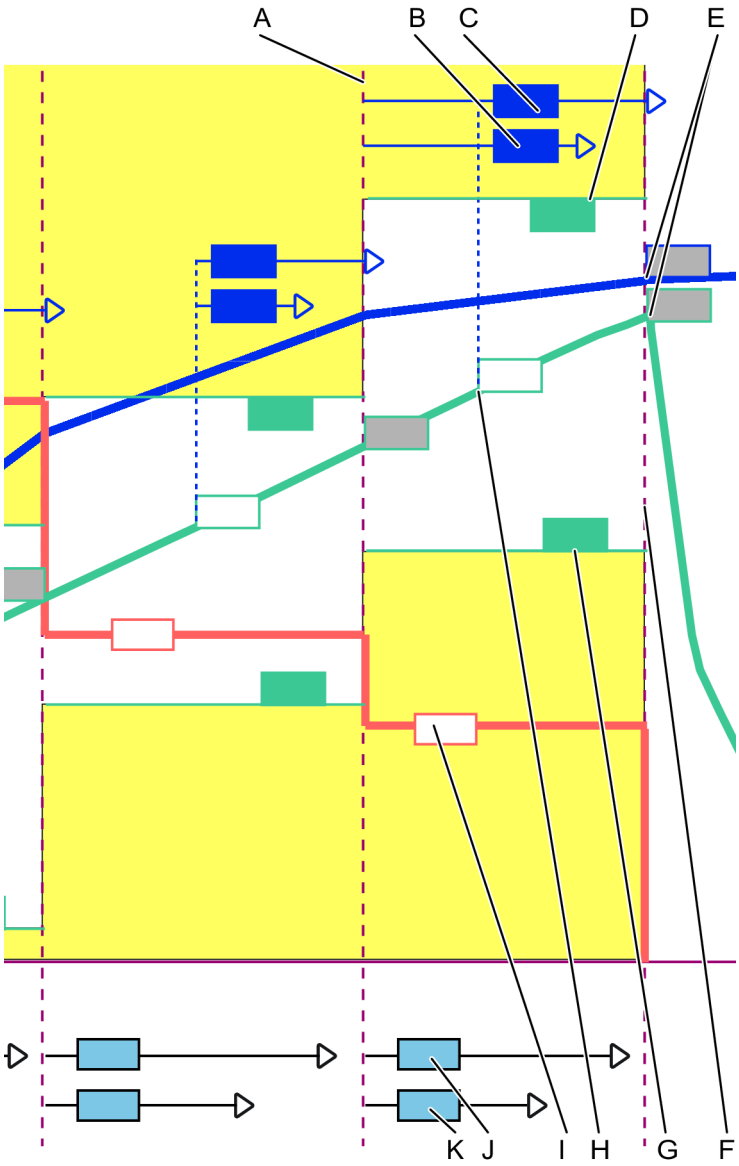
参数	说明	默认值
最初步骤	处于**开**或**关**位置的开关。 如果开关处于**关**位置，那么此步骤不会被执行，并且其他全部参数都是不可见并被忽视的。	开启
第一扭矩	针对步骤规定目标扭矩。 当目标被实现时，步骤结束被定义在此点。	

参数	说明	默认值
第一速度	处于**手动**或**自动**位置的开关。 如果开关位于**自动**位置，则速度将自动设定。 如果开关位于**手动**位置，则速度将手动设定。	20 Nm
最初速度（参数输入框）	本参数输入框仅在**手动**速度设置已选定时可见。 步骤内的转轴旋转速度。以数值 rpm 表示。	345 rpm
最初最小扭矩	步骤内的最小扭矩值。以数字扭矩值表示	19 Nm
最初最大扭矩	步骤内的最大扭矩值。以数字扭矩值表示	21 Nm
最初角度监测扭矩	指定的扭矩值。从这一时间点开始角度监测。	5 Nm
最初最小角度	步骤最小转轴旋转。从**最初角度监测扭矩**开始测量。以度数数值表示。	0 度
最初最大角度	步骤最大转轴旋转。从**最初角度监测扭矩**开始测量。以度数数值表示。	500 度
时间 分钟	步骤最短时间。从步骤开始时开始测量。以毫秒数值表示。	10 毫秒
最长时间	该步骤的最长时间。从该步骤开始时进行测量。以数字毫秒值表示。	500 毫秒
扭矩测量条件	最大扭矩值 达到最大角度时的值 关闭时的值	

四步拧紧参数 – 拧紧步骤的最终拧紧步骤

拧紧步骤分为两个步骤，第一步和最终步骤。**最初拧紧**步骤从旋入完成开始，直至达到**最初扭矩**目标水平时结束。在最初拧紧过程中，监测时间、扭矩和角度。 **最终拧紧**步骤从**最初扭矩**开始，直至达到最终目标水平结束。在最终拧紧过程中，监测时间、扭矩和角度。该步骤的目标值是**目标扭矩**或**目标角度**水平达到时的数值。

本文采用图形表示，以描述配置设定及参数值的含义。任何 GUI 并未使用图形。



四步拧紧 – 拧紧步骤最终步骤中的参数

A	**最终拧紧**步骤的开始	B	最小角度（监测）；从可选择的参考点开始测量
C	最大角度（监测）；从可选择的参考点开始测量	D	最大扭矩水平（监测）
E	最终目标或是**目标扭矩**或是**目标角度**；角度参考点从可选择的参考点开始测量	F	步骤结束
G	最小扭矩（监测）	H	扭矩曲线和**最终角度监测扭矩**参考点
I	速度曲线和速度值	J	最长时间（监测）
K	最短时间（监测）		

目标扭矩和**目标角度**选择之间的参数不同。

参数	说明	默认值
目标	最终目标的下拉菜单选择。 扭矩：拧紧步骤的最终目标是扭矩值。 角度：拧紧步骤的最终目标是角度值。	

参数	说明	默认值
最终目标速度	处于**手动**或**自动**位置的开关。 如果开关位于**自动**位置，则速度由拧紧算法自动设定。 如果开关位于**手动**位置，则速度将手动设定。	自动
最终目标速度（参数）	本参数仅在**手动**速度设置已选定时可见。 步骤内的转轴旋转速度。以数值 rpm 表示。	113
最终目标扭矩	针对步骤规定目标扭矩。 当目标实现时，步骤结束被定义在此点。	
扭矩限值	处于**手动**或**自动**位置的开关。 仅当最终目标值被设定为**扭矩**时，开关才可见。 如果开关位于**自动**位置，则扭矩限值由拧紧算法自动设定。 如果开关位于**手动**位置，则最大和最小扭矩限值将手动设定。	自动
最终最小扭矩	本参数仅在**手动**扭矩限值已选定的情况下可见。 步骤内的最小扭矩值。以数字扭矩值表示。	最终目标扭矩 - 5%
最终最大扭矩	本参数仅在**手动**扭矩限值已选定的情况下可见。 步骤内的最大扭矩值。以数字扭矩值表示。	最终目标扭矩 + 20%
角度限制	下拉菜单针对角度限值选择参考点。 ■ **从扭矩**：角度监测从**最终角度监测扭矩**点开始测量，该值必须大于**最初扭矩**值并且小于**最终目标扭矩。**	
最终角度监测扭矩	指定的扭矩值。从这一点开始角度监测。该数值必须大于**最初扭矩**值并且小于**最终目标扭矩。**	
最终最小角度	步骤最小转轴旋转。测量参考点从下拉菜单的**角度限值**中选取。以度数数值表示。	324 度
最终最大角度	步骤最大转轴旋转。测量参考点从下拉菜单的**角度限值**中选取。以度数数值表示。	396 度
时间 分钟	步骤最短时间。从步骤开始时开始测量。以毫秒数值表示。	10ms
最长时间	该步骤的最长时间。从该步骤开始时进行测量。以数字毫秒值表示。	1000 毫秒
扭矩测量条件	最大扭矩值 达到最大角度时的值 关闭时的值	

最终目标 = 扭矩时的参数

表中指定的数值假设拧紧步骤的最初步骤已开启。

参数	说明	默认值
目标	最终目标的下拉菜单选择。 扭矩：拧紧步骤的最终目标是扭矩值。 角度：拧紧步骤的最终目标是角度值。	
最终目标速度	处于**手动**或**自动**位置的开关。 如果开关位于**自动**位置，则速度由拧紧算法自动设定。 如果开关位于**手动**位置，则速度将手动设定。	自动
最终目标速度（参数）	本参数仅在**手动**速度设置已选定时可见。 步骤内的转轴旋转速度。以数值 rpm 表示。	113
最终最小扭矩	本参数仅在**手动**扭矩限值已选定的情况下可见。 步骤内的最小扭矩值。必须大于**最初目标扭矩**。以数字扭矩值表示。	

参数	说明	默认值
最终最大扭矩	本参数仅在**手动**扭矩限值已选定的情况下可见。 步骤内的最大扭矩值。以数字扭矩值表示。	
最终监督时的最小扭矩	该数值用于监控并确保在整个最终步骤保持最小的扭矩水平。该水平通常设置在低于最终最小扭矩但高于旋入扭矩水平的数值。它还可用于验证螺钉在拧紧过程中没有损坏。	18 Nm
最终目标角度	针对步骤规定目标角度。 目标角度的参考点从先前激活的步骤或步骤结束时开始测量。 当目标实现时，步骤结束被定义在此点。	
角度限制	下拉菜单针对角度限值选择参考点。 ■ **自动**。围绕最终目标值的上下 10% 设定一个窗口。 ■ **手动**。允许手动设置最大和最小值。围绕最终目标值的上下 10% 设定一个窗口作为默认值。	
最终角度监测扭矩	指定的扭矩值。从这一点开始角度监测。参考点取决于先前激活的步骤或阶段。	
最终最小角度	步骤最小转轴旋转。测量参考点从下拉菜单的**角度限值**中选取。以度数数值表示。	324 度
最终最大角度	步骤最大转轴旋转。测量参考点从下拉菜单的**角度限值**中选取。以度数数值表示。	396 度
时间 分钟	步骤最短时间。从步骤开始时开始测量。以毫秒数值表示。	10ms
最长时间	该步骤的最长时间。从该步骤开始时进行测量。以数字毫秒值表示。	1000 毫秒
扭矩测量条件	最大扭矩值 达到最大角度时的值 关闭时的值	

最终目标 = 角度时的参数

四步拧紧参数 — 停止步骤

Soft-stop [页次 50]（软停止）用于以人体工学方式结束停止步骤。

参数	说明
软停止	具有**开**或**关**选择的下拉菜单。 如果软停止已**关闭**，那么工具会在达到最终目标后尽快停止。 当工具速度尽快减小时，可能会产生反作用力。反作用力可能破坏角度测量，其可以采用真实角度补偿来获得补偿。 如果软停止**开启**，那么工具会减弱拧紧速度至舒适停止。

多步骤拧紧策略

说明

警告 存在受伤风险

对拧紧程序配置的更改可能使扭矩、转动方向或拧紧程序目前正使用系统的速度出现异常。这可能导致严重的身体伤害和/或财产损失。

- 在添加新程序或将更改运用到当前程序中后，请检查拧紧程序配置。

多步骤拧紧是分多步进行拧紧。步骤数和步骤类型因要进行的拧紧而异。多步拧紧程序可高度配置，包括监控器功能和限制。

尚未对 STB 工具执行多步骤拧紧策略。

限制

限制用于确保在出现意外情况时停止拧紧。例如，这些限制可测试确保未达到最大扭矩，或多步骤拧紧的部分不会花太长运行时间。每个步骤最多可有 4 个限制。每个步骤有其自己的一套强制步骤限制和可选步骤限制。当将新步骤拖至多步骤程序时，将自动包含强制限制。

监控

监控器用于验证是否根据规定进行拧紧。例如，它们可以为角度限值或扭矩限值。每个步骤最多可有 8 个监控器。每个步骤有其自己的一套强制步骤监控器和可选步骤监控器。当将新步骤拖至多步骤程序时，将自动包含强制监控器。

多步骤 GUI 界面

在 Power Focus 6000 界面和相应的 WEB 界面中，仅可在列表视图中查看并选择多步骤拧紧程序。要创建并编辑 Multistep 程序，请参阅 ToolsTalk 2。在 ToolsTalk 中，可以创建 Multistep 程序并推送至控制器，随后在列表中进行显示。

ST Wrench

STwrench 介绍

STwrench 通过无线连接与控制器相连。STwrench 通过控制器 GUI 或 WEB GUI 进行配置。

STwrench 的配置方法与其他拧紧策略相同，均在拧紧菜单下进行。

STwrench 带有快速备份单元 (RBU)。RBU 定义扳手功能并存储拧紧程序。控制器目前仅支持 **Production**（生产）型 RBU。

STwrench **端部配件工具**（套筒）包含一个带有可编程编号的 RFID 标签。扳手使用此编号自动识别工具和可以使用的程序。RFID TAG 还存储扭矩和角度校正系数。

STwrench 具有适用于生产拧紧和质量控制的多个程序。有关程序、策略和参数的更多详情，请参阅 STwrench 用户指南、文件号 9836 4134。

STwrench 仅支持相关拧紧程序，它们由工具支持且属于*扳手 - 生产*或*扳手 - 质量*类别。

STwrench 启动步骤参数

表中所示的参数仅在使用其中一个 STwrench 策略时才可用。存在多重策略组合。部分参数仅针对特定策略提供且在其他策略中不可见。

自动检查参数规则。如果出现违背的情况，错误的参数旁边会显示错误指示 。将光标置于错误指示符上，可显示有关错误的更多信息。

切换策略可能导致显示错误指示符。这表明所选的组合无效且需要校正。

有关程序的更多详情，请参阅 STwrench 用户指南、文件号 9836 4134。

参数名称	条件	说明	默认值
TAG 编号		利用开关所做的选择。 **开启**或**关闭**位置。 **开启**：需正确的 TAG 编号才可运行此拧紧程序。 **关闭**：未检查 TAG 编号。	关闭
所需 TAG 号	TAG 号 = On	此拧紧程序所需的 TAG 编号。	1
重复拧紧检测		从下拉菜单中选择。参数选项包括： **完成**或**关闭**。.	关闭
扭矩校正系数		在特定情况下，可能需要扩展项来安装此应用.此时，应补偿扳手测量值以显示正确值。 要计算校正系数，请参阅《STwrench 用户指南》印刷品编号 9836 4134 01 第 2.12 版。 参数存储在**端部配件工具**的 RFID TAG 中。	1.0
角度校正		在特定情况下，可能需要扩展项来安装此应用.此时，应补偿扳手测量值以显示正确值。 要计算校正系数，请参阅《STwrench 用户指南》印刷品编号 9836 4134 01 第 2.12 版。 参数存储在**端部配件工具**的 RFID TAG 中。	0°

STwrench 启动步骤的参数

注意 校正系数会改变 STwrench 测量值。它可能导致读数错误。在进行校正前，请参阅《STwrench 用户指南》印刷品编号 9836 4134 01 第 2.12 版。

STwrench 旋入步骤参数

表中所示的参数仅在使用其中一个 STwrench 策略时才可用。存在多重策略组合。部分参数仅针对特定策略提供且在其他策略中不可见。

自动检查参数规则。如果出现违背的情况，错误的参数旁边会显示错误指示 。将光标置于错误指示符上，可显示有关错误的更多信息。

切换策略可能导致显示错误指示符。这表明所选的组合无效且需要校正。

有关程序的更多详情，请参阅 STwrench 用户指南、文件号 9836 4134。

Rundown complete（旋入完成）在 STwrench 文件中定义为**Cycle start**（循环启动），此在拧紧阶段开始时发生。

参数名称	说明	默认值
旋入完成	从下拉菜单中选择。参数选项包括： **达到扭矩**。	
旋入完成扭矩	旋入完成点的定义。	由 smartHead 最小载荷（通常为额定扭矩的 5%）决定（单位：Nm）
棘轮作用时间		5000 ms

STwrench 旋入步骤的参数

STwrench 拧紧步骤参数

表中所示的参数仅在使用其中一个 STwrench 策略时才可用。存在多重策略组合。部分参数仅针对特定策略提供且在其他策略中不可见。

自动检查参数规则。如果出现违背的情况，错误的参数旁边会显示错误指示 。将光标置于错误指示符上，可显示有关错误的更多信息。

切换策略可能导致显示错误指示符。这表明所选的组合无效且需要校正。

有关程序的更多详情，请参阅 STwrench 用户指南、文件号 9836 4134。

参数名称	条件	说明	默认值
目标		从下拉菜单中选择。参数选项包括： **扭矩**或**角度**。	扭矩
目标扭矩		定义拧紧步骤的目标扭矩。	
目标角度	目标 = 角度	定义拧紧步骤的目标角度。	0°
扭矩限值	目标 = 扭矩	利用开关所做的选择。 **自动**或**手动**位置。	
最小扭矩	扭矩限值 = 手动	下限扭矩值	0
扭矩最大值	扭矩限值 = 手动	上限扭矩值	0
角度限制	目标 = 角度	从下拉菜单中选择。参数选项包括： **自动**或**手动**。 可以是最大和最小时的角度值或选择相应角度值	

参数名称	条件	说明	默认值
角度限制	目标 = 扭矩	从下拉菜单中选择。参数选项包括： **关闭**：无角度限值监控。 **从旋入完成开始**：监控窗口设置为从达到**旋入完成扭矩**时开始。 **从扭矩开始**：监控窗口设置为从达到规定扭矩值时开始。	
最终角度监测扭矩		从监控角度限值的位置开始的扭矩值	18.75 Nm
最小角度	角度限值 = 开启或手动	角度值下限	324°
最大角度	角度限值 = 开启或手动	角度值上限	396°
角度搜索限值	角度限值 = 手动		
扭矩测量条件		从下拉菜单中选择。参数选项包括： **最大扭矩值** **达到峰值角度时的值**	
终值小于目标值异常		利用开关所做的选择。 **开启**或**关闭**位置。	开启
更改螺栓限值			50 Nm

STwrench 拧紧步骤的参数

参数名称	条件	说明	默认值
扭矩补偿点	扭矩补偿 = On		0°
PCT 距离	扭矩补偿 = On		360°
PVT 周期	扭矩补偿 = On		180°
延迟监控	扭矩补偿 = On		0°
最小扭矩	扭矩补偿 = On	下限扭矩值	1 Nm
扭矩最大值	扭矩补偿 = On	上限扭矩值	20 Nm
补偿值	扭矩补偿 = On	从下拉菜单中选择。参数选项包括： **平均扭矩** **峰值扭矩**	

策略为“Wrench - Production”（扳手 - 生产）以及“PVT 通过贴合补偿”时 STwrench 拧紧步骤中的参数

STwrench 拧松

表中所示的参数仅在使用其中一个 STwrench 策略时才可用。存在多重策略组合。部分参数仅针对特定策略提供且在其他策略中不可见。

自动检查参数规则。如果出现违背的情况，错误的参数旁边会显示错误指示 。将光标置于错误指示符上，可显示有关错误的更多信息。

切换策略可能导致显示错误指示符。这表明所选的组合无效且需要校正。

有关程序的更多详情，请参阅 STwrench 用户指南、文件号 9836 4134。

参数名称	条件	说明	默认值
松开限值			0 Nm

Stwrench 拧松步骤的参数

STwrench 停止步骤参数

表中所示的参数仅在使用其中一个 STwrench 策略时才可用。存在多重策略组合。部分参数仅针对特定策略提供且在其他策略中不可见。

自动检查参数规则。如果出现违背的情况，错误的参数旁边会显示错误指示 。将光标置于错误指示符上，可显示有关错误的更多信息。

切换策略可能导致显示错误指示符。这表明所选的组合无效且需要校正。

有关程序的更多详情，请参阅 STwrench 用户指南、文件号 9836 4134。

参数名称	条件	说明	默认值
结束循环时间			100 ms

Stwrench 拧松步骤的参数

批次配置

批次序列

批次序列用来按特定的顺序执行指定的拧紧次数。为各批次序列命名。

批次序列设置

批次序列 > <Selected sequence> > **设置**

批次序列最多可由 99 个批次组成，批次容量最多为 99 次拧紧。批次序列中的批次按所列顺序执行，或者通过使用套筒选择器来决定运行哪个批次。

参数名称	说明	默认值
批次序列完成后，工具锁定	批次序列计数器等于批次序列大小时，批次序列完成。 **开启：**工具会被锁定，必须选择拧紧程序或批次序列，才可继续执行拧紧操作。 **关闭：**完成后，批次序列已准备好重复。	开启
无序	**No（否）：**如果已配置了批次来执行拧紧操作，则将按所列顺序执行这些经过配置的批次。如果已指定套筒，则在即将执行批次时，系统将会提示提供套筒。 **Yes（是）：**经过配置的批次可按任意顺序执行。操作人员必须通过使用套筒选择器，向系统指明执行哪个批次。 当所有连接件均已成功完成时，批次会被视为“完成”。	否
NOK 数增加	尽管拧紧操作被报告为 NOK，但仍然可增加批次计数值。要使最大连续 NOK 工作（可以拧紧单根螺栓的最大时间数），须将 NOK 增量设为 **No**（否）。如果将此参数设为 Yes（是），将使序列进入下一次拧紧。	否
最大连续 NOK 次数	最大连续不正常拧紧 (NOK) 次数是指批次中允许的连续不正常拧紧的最大次数。如果达到 **Max consecutive NOK**（最大连续 NOK 次数），显示事件**Too many NOK tightenings (4020)**（不正常拧紧次数过多 (4020)）。	0
顺序中断计时器	**开启：** 选定批次序列可以在规定时间限制范围内中断 **关闭：**选定批次序列不能中断。	关闭
中断时间 (10-600)	选定批次序列可以中断的秒数范围。	10

批次设置参数

批次配置

批次序列 > <Selected sequence> > 批次配置

设定批次，以使用同样的拧紧程序来执行指定的连续拧紧次数。必须为批次指定拧紧程序和批次容量，才可运行批次。

参数	说明
拧紧程序	要在批次中使用的拧紧程序。
批量大小	批次将要执行的拧紧次数。 一个批次的最大拧紧次数为 99。 批次容量为 0 表示批次的拧紧次数无穷大。
识别码数字	在使用套筒选择器时，此套筒位置用于激活批次。

批次配置参数

虚拟站点

虚拟站点在**虚拟站点**菜单中配置。

虚拟站点是物理站的软件抽象化表述，可以设置为使用特定的工具并使用工具远程执行不同的任务。

在 Power Focus 6000 中，每个控制器可以设置大量虚拟站点。每个虚拟站点都可以与一个工具及一个或多个附件连接。

通过使用虚拟站点，操作员可以使用相同的控制器操作多个工具和运行不同的任务。可以将一个线缆工具和多个 STB 工具同时连接至控制器。

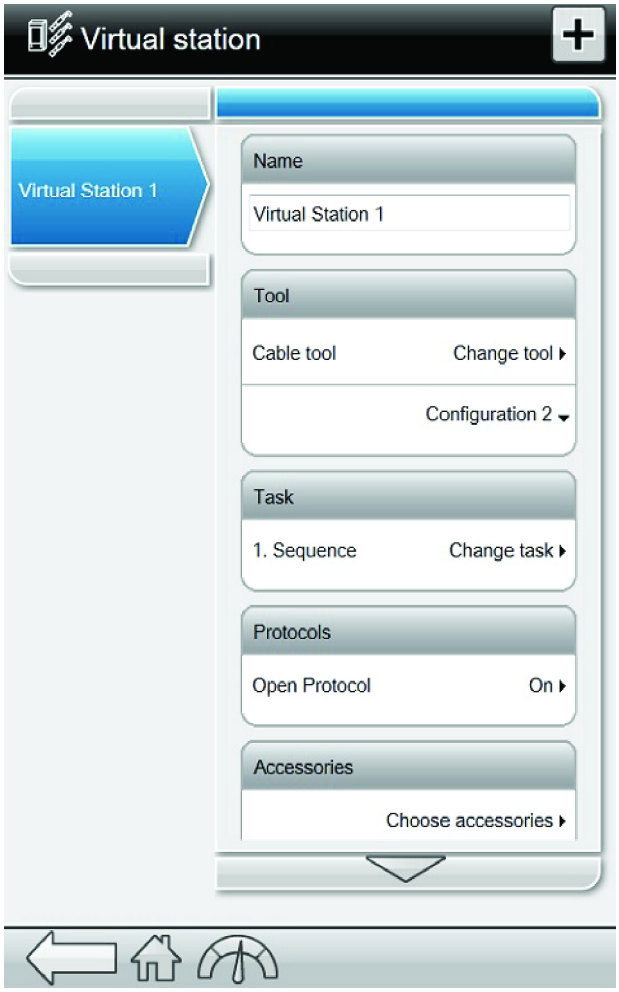
配置不同的工具时，确保启动来源中选定的启动信号与选定的工具匹配，并且选定的任务可以在特定工具上运行。

在可以开始拧紧前，应在虚拟站点菜单中选择一个任务。任务为以下三种类型任务中一种：

- 拧紧程序
- 批次序列
- 源

可以由操作员手动选择或通过外部信号选择。有关外部信号的信息，请参见 *源 [页次 85]*。

虚拟站点 – 创建虚拟站点



创建虚拟站点

要创建新的虚拟站点：

1. 轻击加号“+”。

2. 编辑名称和其他参数。

要删除虚拟站点：轻击参数列表底部处的“删除”即可。

创建的虚拟站点列表将按创建的顺序显示。

如果在分配工具时无可用的工具配置，将会自动创建新的工具配置并将其分配给虚拟站点。

此自动创建的工具配置将把“启动源”设为 **Trigger only**（仅限触发器）并将“图示绘制”设为 **Off**（关）。对 STB 工具而言，“启动请求”将设为 **On**.（开）。

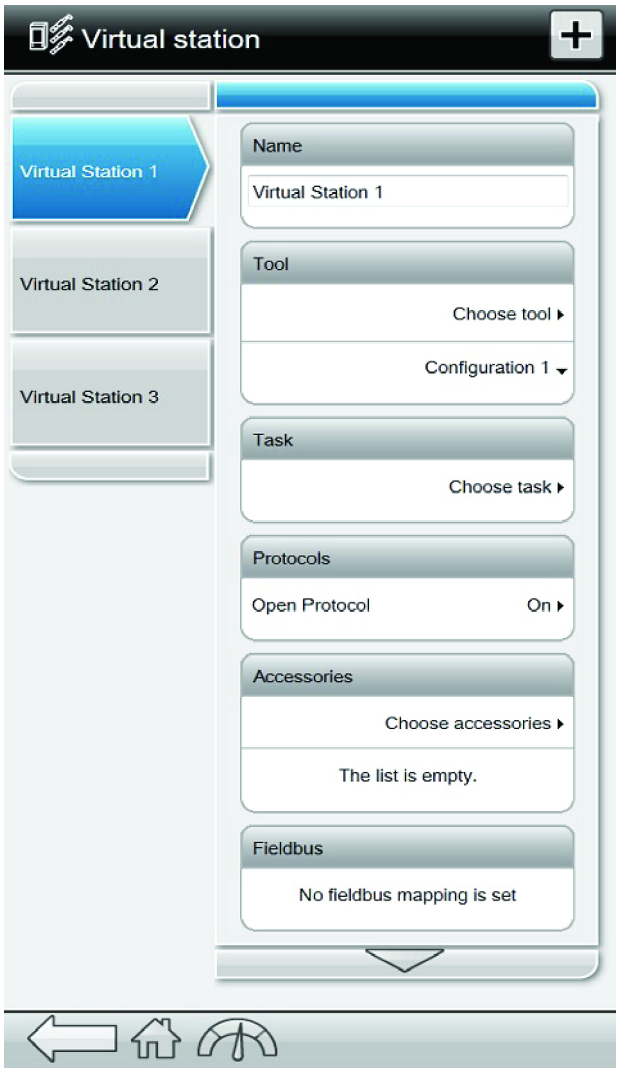
虚拟站点 – 工具设置

工具已连接到虚拟站点

虚拟站点只可连接一个工具。与控制器相连的工具中只有一个工具可以是电缆工具。添加的虚拟站点可以将匹配的无线工具连接至控制器。

除工具外，每个虚拟站点还需一个工具配置。可在 **Configurations**（配置）菜单创建工具配置，参见 *配置 [页次 89]*。

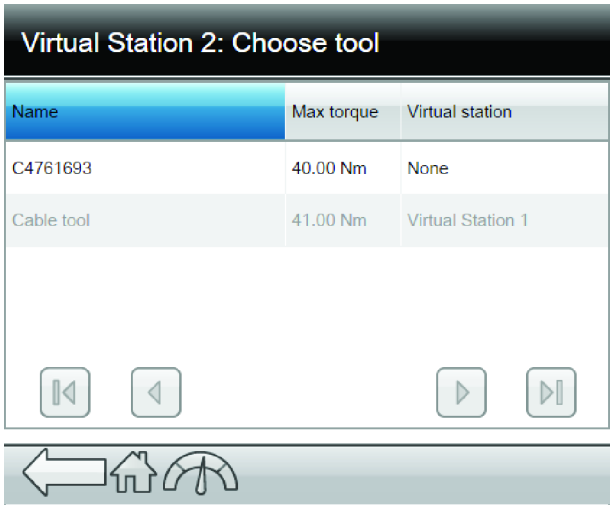
将工具连接到虚拟站点



虚拟站点菜单

1. 转至**虚拟站点**菜单并点击要连接工具的虚拟站点。

2. 在工具区域，点击**选择工具**以打开可用工具的列表。
   或者，如果已选择工具，点击**Change tool**（更改工具），打开可更改的工具列表。

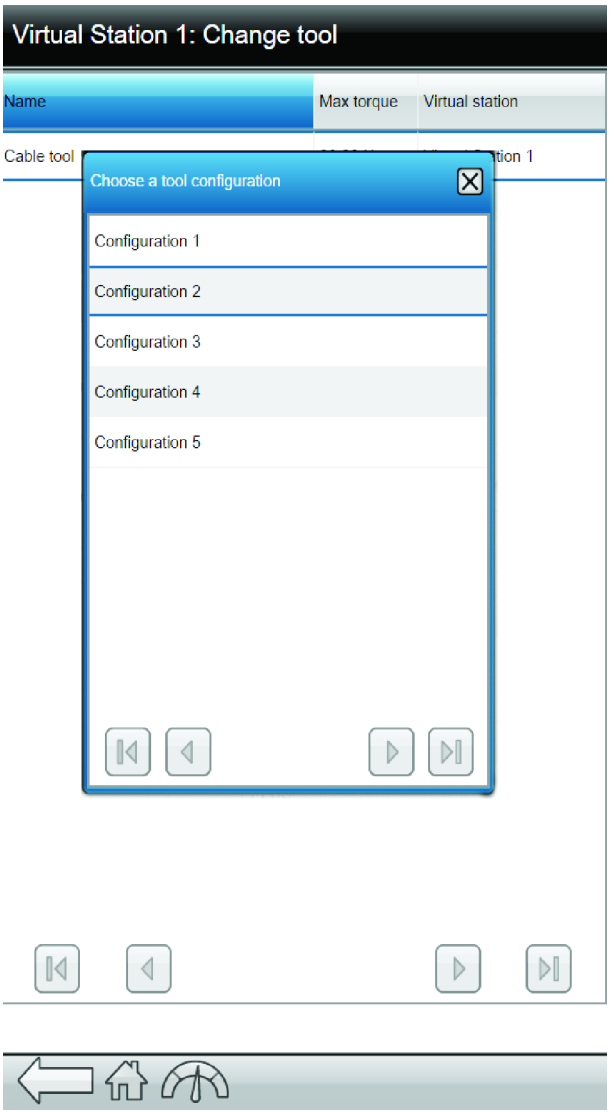


工具列表

3. 在可用工具的列表中，点击要连接至虚拟站点的工具。

   不可用的工具将以灰色显示。要连接此类工具，首先必须将其与对应的虚拟站点断开。

4. 当连接新的工具时，需附上工具配置。如果有多个可用的配置，则会显示工具配置列表。



配置列表

可以编辑配置，详情请参见*工具配置 [页次 89]*。

5. 要替换虚拟站点的工具配置：
   - 单击当前配置名称旁的箭头图标。
   - 从列表中选择另一个配置。

   不得取消选择配置，只可以选择另一个可用的配置。

虚拟站点 - 任务

选定的任务可以是运行一个拧紧程序、运行一个批次序列或者使用Sources（来源）菜单中配置的来源启用此任务。

可以从控制器监控任务，并且任务结果可以与操作中可能发生的任何事件一起显示。

虚拟站点 - 手动模式

当工具处于锁止模式时，虚拟站点手动模式用于执行任务。在工具因某些原因锁定时（比如因为工具超出 TLS 规格），仍可能需要用工具执行某些任务，如执行紧急工作。通过配置虚拟站点手动模式，用户可以确定在输入手动模式（进入信号）时发送的何种信号、在手动模式（二级任务）下执行的具体任务以及在离开手动模式（离开信号）时发送的何种信号。

鉴于不同用户所需的环境有所不同（即根据进入和退出及执行的任务发送哪些信号），各虚拟站点手动模式可完全配置。

配置手动模式

配置包含三个要素：进入信号、离开信号和二级任务（注意：主任务是指分配到 *Task*（任务）下的虚拟站点的“自动”任务）。

1. 进入 **Virtual station**（虚拟站点）菜单，单击要配置的虚拟站点，然后在 *Task*（任务）下单击 **Set manual mode**（设定手动模式）
2. 在手动模式配置页面下，设定二级任务。这将确定哪些任务应在手动模式下运行。

   如果未设定二级任务，将在手动模式下使用主任务。

   可以将二级任务与主任务的任务设为一样（拧紧、批次序列、来源）。
3. 单击 *Entering*（进入）一节下方的**加号**（+）图标，设定要发送的输入信号。参见下方输入信号的参数。
4. 单击 *Leaving*（离开）一节下方的**加号**（+）图标，设定要发送的离开信号。参见下方离开信号的参数。

对于进入和离开，存在设定 99 个信号的限制。

进入/离开信号

进入和离开信号的参数相同。

有两种信号类型：布尔和整数/字符串类型。对于布尔类型信号，使用 On/Off（真/假）开关。对于整数/字符串类型信号，使用文本字段指明 (I/O) 信号或字符串。

信号	类型	默认值
通用 IO [1-10]	整数	0
确认事件	布尔	关闭
终止顺序	布尔	关闭
重置过多 NOK	布尔	关闭
设置双稳态继电器	布尔	关闭
外部监控 [1-8]	布尔	关闭
停用现场总线	布尔	关闭
解锁工具开启禁用	布尔	关闭

进入和离开信号手动模式

触发手动模式

可以通过开关或外部系统启用手动模式。例如（下文所示），可以配置操作面板上的按钮来启用手动模式。

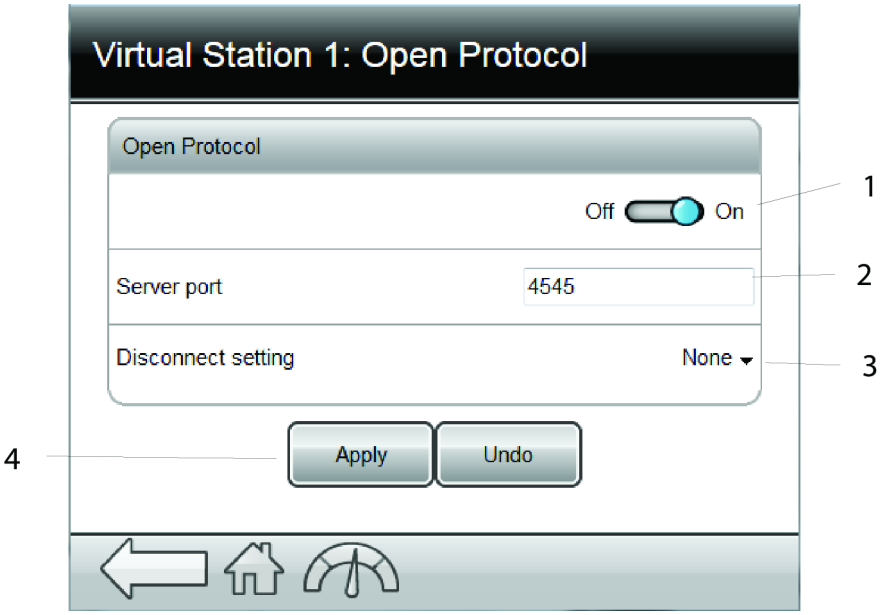
1. 进入 **Configurations**（配置）菜单并选择左侧导航中的 **Operator panel** （操作面板）。
2. 如果不存在操作面板配置，单击工作区顶部右侧的**加号**（+）图标，否则将继续下一步。
3. 在希望改变的配置中，单击 **Edit**（编辑）。
4. 在操作面板配置窗口中，单击位置[A,B,C,D,E,F,G,I]进行配置。
5. 在位置配置窗口中，单击组件列表。在列表中，单击 **One way key switch**（单向键开关）。
6. 单击旋转信号列表。在列表中，选择手动模式（必要时使用箭头按钮在列表中导航）。
7. 关闭位置配置窗口。

如果需要系统提醒用户已进入或离开手动模式，则须分别配置 4070 和 4071 事件。参见 *配置事件 [页次 115]*，了解配置事件的信息。

虚拟站点 – 协议

在虚拟站点菜单中的 **Protocols**（协议）选项卡下，您会找到可用通讯协议的列表，具体视当前使用的许可证而定。开放协议适用于所有许可证。

要通过开放协议访问功能，须定义各虚拟站点的唯一端口。



开放协议设置

1. 将“开放协议”开关置于**On**位置。
2. 输入端口号。
3. 当与客户连接丢失时，选择要应用的操作。
4. 轻击或单击**应用**。

当出现连接错误时，断开设置会控制应用的操作：

- **无** – 拧紧程序如常继续。
- **锁定工具** – 工具在正常完成当前拧紧操作后锁定。
- **Deselect task**（删除工具） – 在完成进行中任务后终止拧紧。但不适用于常规拧紧程序或批次序列，其中将在完成操作后删除任务。

虚拟站点 – 附件

要连接 QIF 附件与虚拟站点或断开连接，请参见 *将 QIF 附件连接到虚拟站点 [页次 98]* 和 *将 QIF 附件从虚拟站点断开 [页次 98]*。

要通过附件的 I/O 诊断功能进行故障排除，请参见 *数字信号诊断 [页次 81]*。

另参见

将 QIF 附件从虚拟站点断开 [98]

数字信号诊断

诊断工具在部署和故障排除控制器过程中极其有用。它适合在 **Virtual station**（虚拟站点）菜单的设备配置或现场总线映射的信息标签下进行分析。

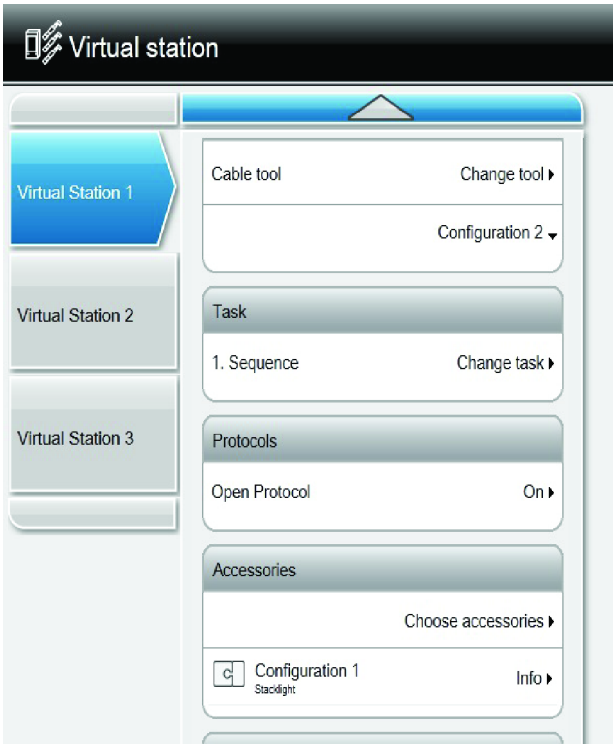
控制器可采用正常模式或诊断模式运行。在正常模式下，数字输入和输出信号正常运行，并且向内部控制器逻辑和外部附件或控制器发送。

诊断模式分为监控模式和强迫模式。在监控模式下，信号正常运行，但提供信号行为的现场监控。在强迫模式下，控制器内部逻辑与外部附件之间的连接开启，并且输入和输出信号可以强迫变为想要的状态。

每次可以为一个设备或一个现场总线诊断数字信号。

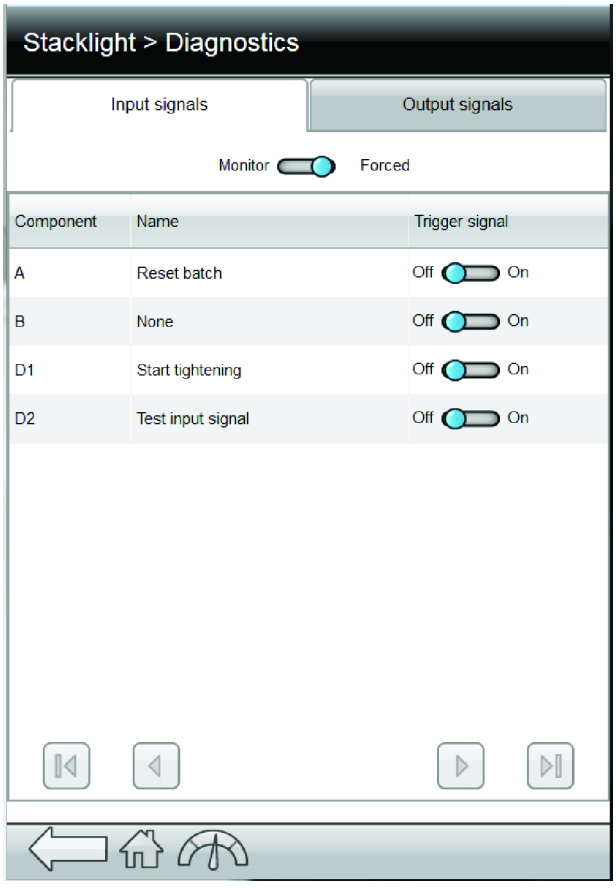
诊断配置

针对特定附件或现场总线的诊断可通过针对附件或现场总线的虚拟站点视图中的信息选项来访问。



虚拟站点菜单

1. 点击**信息**并在下一屏幕上点击**诊断。**
2. 采用开关激活**监控模式**或**强迫模式**。
3. 输入信号和输出信号的状态可在各自的标签下获取。



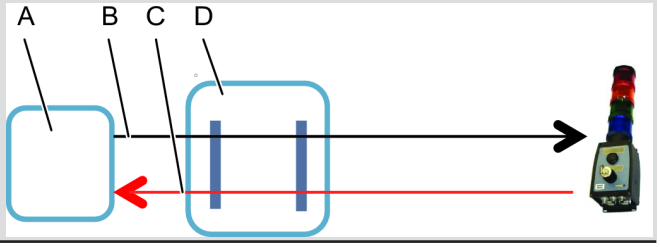
诊断视图

每次只可以从单一用户或功能访问诊断。如果诊断已在使用中，则屏幕上出现信息消息。

常规操作

在常规操作模式下，外部输入信号传送给内部控制器逻辑并且控制器外部信号传送给外部目标，没有任何来自诊断模块的干扰。

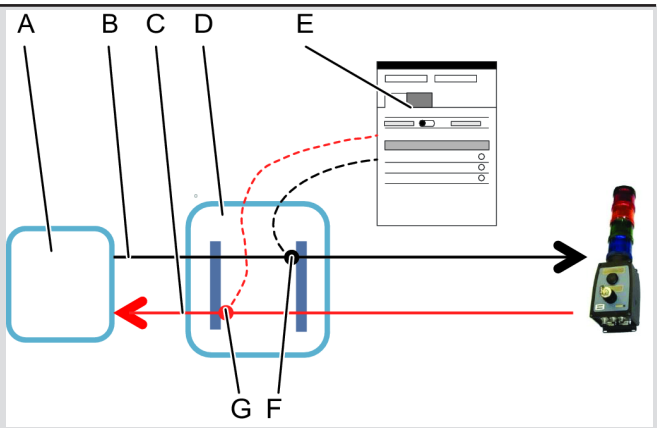
A) 控制器内部状态机器和逻辑功能
B) 数字输出信号路径
C) 数字输入信号路径
D) 诊断模块



监控数字信号

在诊断模式中，可以监控所有传送至控制器内部逻辑并从控制器内部逻辑传输的信号。信号分接头在诊断模块中连接，并且信号状态在WEB GUI 或控制器 GUI 中显示。

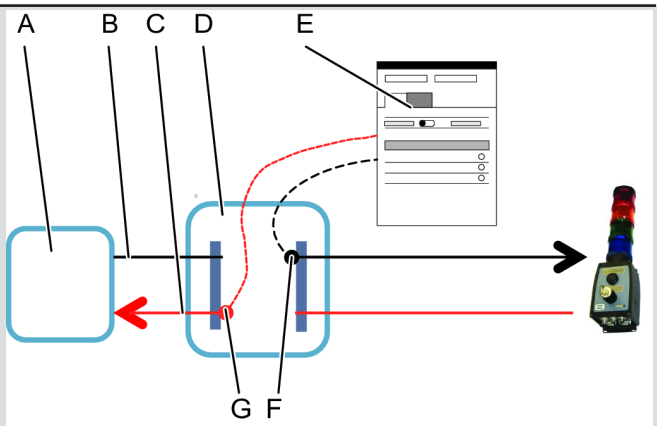
A) 控制器内部状态机器和逻辑功能
B) 数字输出信号路径
C) 数字输入信号路径
D) 诊断模块
E) 用户界面
F) 输出信号分接头
G) 输入信号分接头



强迫数字信号

在诊断模式中，可以使所有传送至控制器内部逻辑并从控制器内部逻辑传输的信号进入所需状态。信号线在诊断模块中打开。输入和输出信号均可从用户界面被强迫到稳定状态。用户接口既可以是 WEB GUI，也可为控制器 GUI。

A) 控制器内部状态机器和逻辑功能
B) 数字输出信号路径
C) 数字输入信号路径
D) 诊断模块
E) 用户界面
F) 强迫输出信号插入点
G) 强迫输入信号插入点



虽然信号被强迫，但控制器正常运行。当离开诊断模式和强迫模式时，所有信号都被设定为控制器的当前操作状态。这可能导致数字输出的状态改变，从而造成不必要的行动。

虚拟站点 – 现场总线

GUI 中的**现场总线**条目显示分配给控制器的现场总线映射。

要分析现场总线配置，单击诊断栏的“perform”（执行），进行现场总线映射。了解本章“虚拟站点 – 附件”一节的诊断工具的更多信息。

虚拟站点 – 现场总线

源

来源简介

用作拧紧任务的外部信号在 Sources（来源）菜单中配置。来源为与虚拟站点相连的附件或同类附件。提供两类来源任务：

- 来源**拧紧**任务
- 来源**批次**任务

来源拧紧用于选择单个拧紧程序。

来源批次用于选择批次序列 - 一系列拧紧程序。

有关任务选择的信息，请参见 。

拧紧

拧紧菜单显示来源拧紧配置的列表。通过进入相关的虚拟站点并选择“ Task, Change task”（任务，变更任务），可以将单独列表与虚拟站点关联。在此可以将来源选为任务。来源拧紧将特定拧紧程序与标识符编号关联。当将标识符编号发送至控制器（通过外部数字信号或在使用套筒选择器的情况下提升选择器中的相应套筒），关联程序将一直运行，直至发送不同的信号（或捕获到套筒）。不存在批次计数。

可以在控制或确认模式下设定来源拧紧列表。

控制

当设为控制时，外部来源通过请求标识符编号选择拧紧程序。如果是套筒选择器，将标识符编号关联到套筒选择器中的相应套筒，通过抬升套筒选中拧紧程序。

确认

在确认模式下，不得将套筒选择器用作控制来源。在此模式下，将标识符编号关联至拧紧程序和特定套筒（在列表新增列中予以指明）。当（通过外部信号）请求标识符编号时，在套筒选择器中弹出相应套筒提示；在操作员抬升套筒（禁用其他套筒）时，会启用拧紧程序。如果未指定套筒（即在套筒列设为 0），将直接启用拧紧程序并忽略套筒状态。

创建来源拧紧

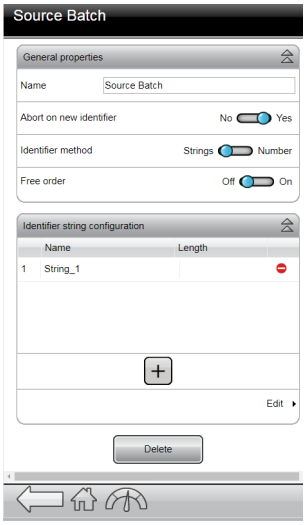
1. 进入 Sources（来源）菜单，然后在左侧导航中选择 Tightening（拧紧）。
2. 单击工作区右上部的**加号**（+）图标。
3. 给“来源拧紧”命名并选择正确的 Selector mode（选择器模式）（无论控制或确认，取决于所需的内容）。
4. 在创建新的来源拧紧时，默认只提供一个可编辑的标识符号。在页面底部，单击**加号**(+)图标，添加更多。
5. 给每个项一个标识符编号

   如果使用套筒选择器，标识符编号对应套筒选择器中的位置，标识符编号 1 对应套筒选择器内的套筒编号 1。
6. 单击 Program（程序）并从拧紧程序列表选择，选择与每个标识符编号相关联的拧紧程序。

批次

来源批次配置请参见“来源”菜单的**批次**选项。

控制器经配置后可选择基于标识符编号或标识符字符串的批次序列。



输入	说明
识别码数字	编号应为正整数，其可能来自附件或外部控制实体。
标识符字符串	字符串必须由 ASCII 字符组成，可以来自扫码枪或外部控制实体。
套筒选择器	使用一个或多个套筒选择器。

创建来源批次

1. 进入**来源**菜单，然后在左侧导航中选择**批次顺序** 。
2. 单击工作区右上部的**加号**（+）图标。
3. 给来源批次命名
4. 如果扫描新的标识符字符串中止之前扫描，将**中止新的标识符**设为**是**。
5. 选择**标识符方法**（文本字符串或数字串数）
6. 给标识符字符串命名，指明在**长度**字段中整个字符串的长度。*参见组合标识符字符串 [页次 87]*，了解连接字符串的更多信息。
7. 指明在字符串中的分辨位。*参见配置分辨位，以读取条码字符串 [页次 86]*，了解分辨位的更多信息。
8. 通过在**保存位**字段中输入位置，指明字符串中哪些位置需要记录。*参见已保存的位置 [页次 87]*，了解有关保存位的更多信息。
9. 单击 **编辑**。
10. 在**编辑**窗口中，指明应将哪些字符串（在**字符串中包含**列）与哪些批次序列（在**启用**列）关联在一起。单击底部的**加号**(+)号图标，添加更多字符串。

分辨位

分辨位的作用是，将字符串组合成您预定义的字符串时，定义读取条码字符串中的哪个字符。分辨位的数量必须与预定义字符串中的字符数量相同。

配置分辨位，以读取条码字符串

条形码字符串中的位与 1 到 1024 之间的一个数字相关。字符串的第一位是 1，最后一位是 1024。

分辨位必须根据下表中给出的规则规定。条形码字符串：

说明	分辨位	有效配置	与预定义字符串匹配的条码字符串
顺序排列分辨位	1,2,3,7,8 将自动变更为 1-3,7-8	OK	ABCGH
以可选顺序排列分辨位	7,1,2,3,8 将自动变更为 1-3,7-8	OK	GABCH
数字范围	1-3,7-8	OK	ABCGH

组合标识符字符串

用于匹配的*标识符字符串*由最多四个来自工厂管理系统的字符串组成，或者由最多四个需要组合成一个字符串的条形码枪输入组成。

Add（添加）和 **Delete**（删除）命令按钮用于管理有多少字符串被组合。提供以下参数：

参数	说明
复选框	选择要删除的条目
名称	字符串应为指定名称。
长度	字符串的长度应已知且须输入。这对能够组合正确的字符串标识符十分重要。
开始-结束	组合字符串内字符的位置。
分辨位	组合字符串中的分隔号位置或范围（由连字符分开）供匹配使用。
已保存的位置	将被保存到结果的字符串中的逗号分隔位置或范围。

组合识别码字符串的参数

如果使用多个*标识符字符串*，则执行以下步骤：

1. 按下**添加**指令按钮，在表中创建新条目。
2. 为字符串命名。
3. 输入字符串的长度。
4. 对要添加的每个字符串重复步骤 1-3。最多可以组合四个字符串。

每行中的“开始-结束”参数定义各字符串在匹配过程的接下步骤中使用的组合*字符串标识符*。

任务选择过程使用*标识符字符串*作为输入的第一部分用于定义字符串中将要使用的位置。

- 输入分辨位置以定义*识别码字符串*中将用于匹配的位置。此类位置应以逗号分隔或排列。

已保存的位置

保存位是一个字段，其中用户可以指明保存来源批次中使用的每个字符串哪些部分，以及如何在日志中进行反映。在此字段中，指明需要在字符串中保存的位置。位置可能只构成整个字符串的一部分。如果字段留空，将保存整个（相连）字符串。下表只显示保存位组合的部分示例。

保存位值用逗号分开（不带空格），范围使用连字符指明。

标识符字符串	位置
字符串 1：1234567	1-7
字符串 2：abcdef	8-13
字符串 3：GHIJKL	14-19
字符串 4：890	20-22

已保存的位置	保存结果
（空）	1234567abcdefGHIJKL890
1-3,9,11,15,20-22	123bdH890
8-12,1-7,19,20-21 将自动变更为：1-12,19-21	1234567abcdeL89

保存位示例

配置

工具附件和 QIF 附件的配置通过 **Configurations**（配置）菜单提供。条形码枪通过 **Sources**（来源）菜单上的“Batch”（批次）视图配置。

数字信号

输入信号

输入信号是指可以通过附件（工具附件或 QIF 附件）上的按钮或开关或者将信号连接至 I/O 输入插头来执行的系统指令 。要获取可用输入信号的完整列表，请参见*输入信号 [页次 127]*章节。

输入信号锁定工具不得针对一个虚拟站点对应多个附件配置。

输出信号

输出信号是指系统的状态或事件。它们可以连接至工具附件或 QIF 附件。可用输出信号的完整列表请参见*输出信号 [页次 128]*章节。

工具配置

通过**Configurations**（配置）菜单下的“工具配置”菜单对工具的可用附件功能进行配置。

根据工具类型的不同，将提供不同的功能。要访问合适的功能，请选择**Filter by tool type**（按工具类型过滤）下的工具。可用类型包括：

- 电缆工具
- STB 工具
- STwrench
- SRB 工具
- TBP 工具

轻击或单击“编辑”，进入不同功能的配置。

工具配置按字母表顺序列出。

不得删除指定给虚拟站的配置。

对于 STB 工具和电缆工具：要配置蜂鸣器、功能按钮或方向开关，请轻击屏幕图示下方的相应字段。将出现所选功能的菜单。

在此配置工具的启动条件，如启动源、图示绘制和启动请求。具体功能将在相应章节描述。

一般设置

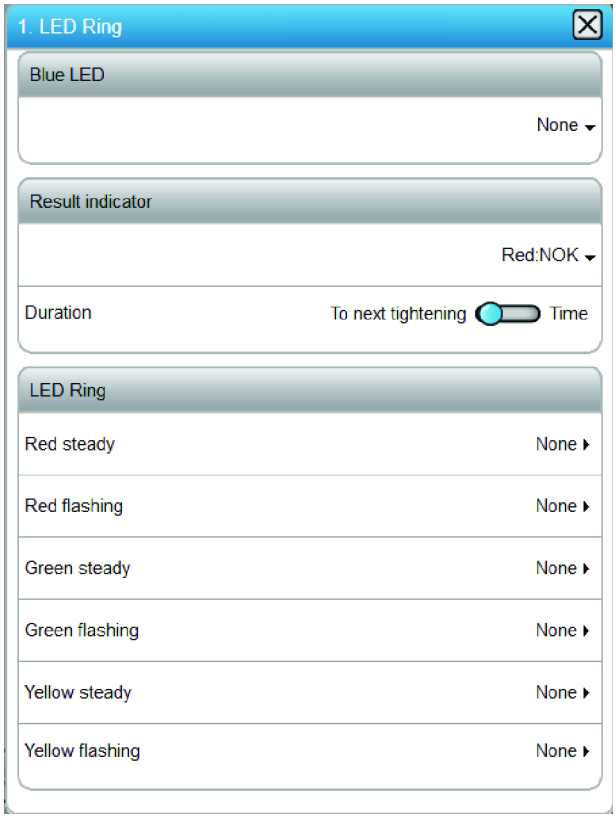
可以在一般设置部分设定工具一般设置。

参数	说明	默认值
停机超时	确定工具在设定的停机时间期后自行关机。	开启
〈停机超时〉	如果将停机超时设为开启，设定关机前的分钟数。	120 分钟

参数	说明	默认值
追踪	设定启用结果绘制图（在结果页面显示的图表）的时间：按下触发器或旋入完成	关闭
TAG 检查	确定是否在套筒上进行 RFID TAG 检查（STWrench）	关闭
TAG 选择	确定是否将 TAG 选项用作所选的输入通道 (STWrench)	关闭

工具 LED

工具上的不同 LED 指示灯配置为由其中一个可用的输出信号进行控制。



LED 配置

蓝色 LED

蓝色 LED 为具有稳定信号的独立 LED。蓝色 LED 将在配置的持续时间内点亮或配置为在进行以下拧紧前点亮。它通过配置所选的信号点亮。

结果指示灯

结果指示灯确定点亮拧紧结果 LED 的方式及时长。从快捷菜单选择预配置的方式。此方式可以为不同拧紧结果的组合。

信号	说明
关闭	无论结果如何，在拧紧后均无法启用任何 LED 指示灯
绿色	如果选定结果指示灯，绿色指示灯为默认信号，前提是正常结束拧紧(OK)。
红色:高:黄色:低	如果不正常结束拧紧(NOK)，红色 LED 指示灯表示最终值过高，或黄色 LED 指示灯表示最终值过低。
红色:NOK:黄色:低	红色 LED 指示灯表示不正常结束拧紧(NOK)。附加黄色 LED 指示灯可以指示，此值是否过低。

信号	说明
红色:NOK	红色 LED 指示灯表示不正常结束拧紧(NOK)。未显示其他 LED 指示灯。

结果指示灯信号

LED 光环

LED 光环确定 LED 指示灯在两次拧紧之间的工作方式。LED 光环包括三圈 LED 指示灯：一圈红色 LED 指示灯、一圈黄色 LED 指示灯和一圈绿色 LED 指示灯。每圈均会有稳定信号或闪烁信号。这共提供六种可以与 LED 光环相连的不同信号。

- LED 指示灯仅在无持续拧紧且启用控制输出信号时才会亮起。
- 当超过最大时间时，LED 指示灯熄灭。仅在信号类型为**Event**（事件）时才适用。
- 当开始下一次拧紧时，LED 指示灯熄灭。
- 当控制输出信号停用时，LED 指示灯熄灭。仅在信号类型为**State**（状态）时才适用。

功能按钮

使用工具上的功能按钮可控制多达 6 个可用输入信号。按钮的三种可能条件状态结合方向开关的两种可能状态使用。

功能按钮状态	方向开关状态
推一次	顺时针
推一次	CCW
推两次	顺时针
推两次	CCW
按下	顺时针
按下	CCW

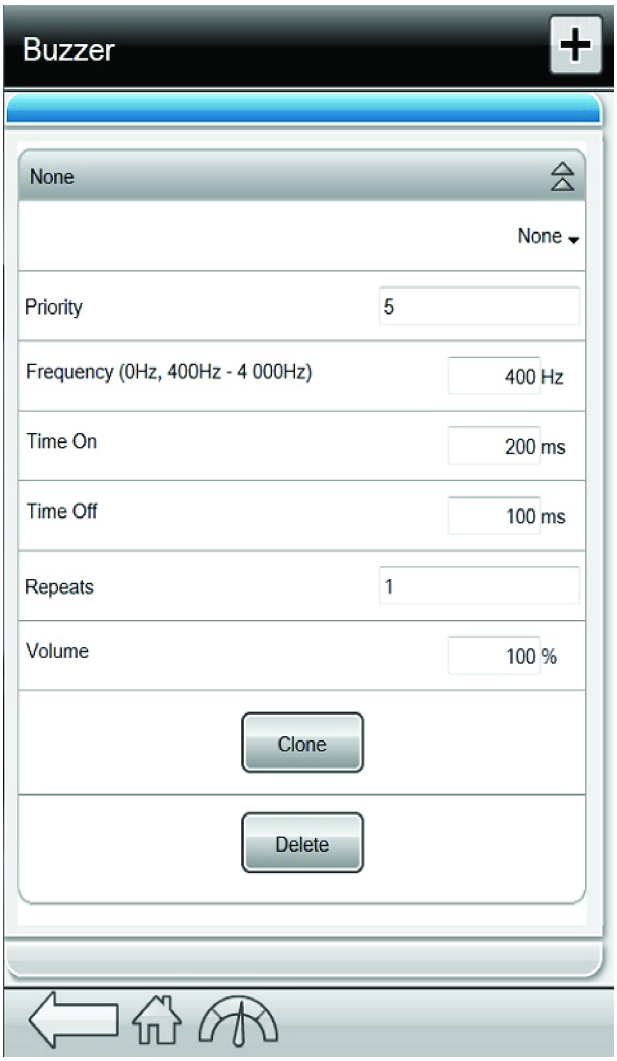
两个可配置参数控制推动时间。

参数	说明	默认值
推动检测间隔	推一次：按下按钮和松开按钮的最大推动时间间隔（毫秒）。	300 ms
下一次推动间隔	推两次：首次推动后松开按钮和再次按下按钮的最大时间间隔（毫秒）。	300 ms

蜂鸣器

通过将声音分配给从可用信号列表中所选的信号，对蜂鸣器进行配置。

声音包括表中所述的一组参数。可以将信号及声音按照 1 - 10 优先排序，其中“1”表示最高优先级，“10”代表最低优先级。信号和声音的默认优先级是 5。可向信号分配最多 20 个声音。



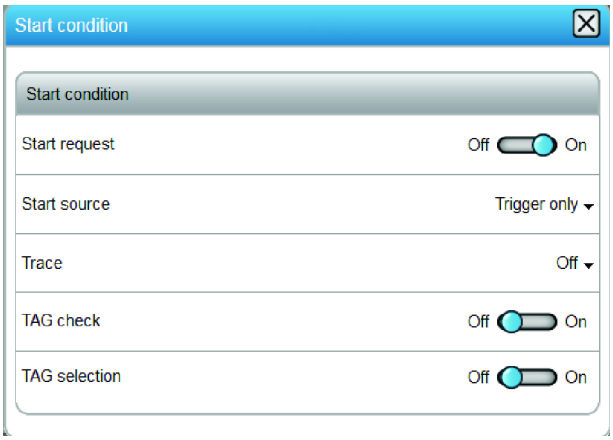
参数	说明
频率	精确频率以赫兹表示。
计时开启	蜂鸣器发出声音的时间（毫秒）。
计时关闭	蜂鸣器静音的时间（毫秒）。
重复	蜂鸣器重复开关顺序的次数。
音量	蜂鸣器音量，以占最大音量的百分比表示。

方向开关

工具上的方向开关经过配置后，可在从顺时针 (CW) 快速切换至逆时针 (CCW) 及向后转动时触发一个输入信号，反之亦然。

启动条件

在此配置工具的启动条件，如启动请求、启动源、图示绘制和 ST Wrench 的 TAG 条件等。具体功能将在相应章节描述。



启动条件

开始请求

启动请求可实现工具与控制器之间针对 STB 工具的持续连接之要求。此举是为了确保工具始终与拧紧程序或批次设置，及与控制器上的其他设置，在执行拧紧时保持最新更新状态。

将“启动请求”设为“开启”时，如果工具与控制器之间的连接断开，则工具被锁定。这意味着，如果在拧紧中途或批次序列中途，工具的连接断开，则工具将完成当前拧紧，然后停止。随之工具将被锁定，直到重新建立连接为止。

参数	说明	默认值
开始请求	在工具与控制器之间的连接断开时，锁定工具。 **开启**：如果工具与控制器之间连接断开，则工具被锁定，不会继续执行拧紧。 **关闭**：虽然工具与控制器之间的连接断开，但工具仍会继续执行拧紧。	开启

适用于启动请求的参数

启动来源

使用工具启动来源可设置如何启用工具。默认值为 **Trigger only**（仅限触发器）。

启动源不适用于 ST Wrench

启动来源	说明
仅触发器	按下工具触发器开始拧紧操作。
触发“或”按压	按下工具触发器或者将工具压向连接件，开始拧紧操作。
触发“与”按压	按下工具触发器并将工具压向连接件，开始拧紧操作。
仅按压	将工具压向连接件开始拧紧操作。
数字输入	用数字输入信号触发启动拧紧操作。
安全触发器	两个触发器（和触发与按动一样）在 500 ms 内相互启用以启动拧紧。

启动源选项

追踪配置

绘制图为用户提供以图示形式再现的拧紧过程。绘制图可以从按下触发器时开始或者从旋入完成后开始。

参数	说明	默认值
追踪	允许以图形方式查看结果。 **关**：不进行追踪。 **按下了触发器**：追踪从按下工具触发器时开始绘制。 **旋入完成**：追踪从**旋入完成**时开始。	关闭

TAG 检查

TAG 编号为 RFID TAG，用于识别 STwrench 中的端部配件工具。

TAG 检查	说明
关闭	未进行 TAG 检查。
开启	检查**端部配件工具**（套筒）的 TAG 编号。TAG 编号应与拧紧程序配置中的编号相同

TAG 选择

TAG 编号为 RFID TAG，用于识别 STwrench 中的端部配件工具。

开始请求	说明
关闭	TAG 值不用于选择批次。
开启	使用**端部配件工具**（套筒）的 TAG 编号来选择批次序列中的某一批次。应将 TAG 编号写入“批次序列”菜单下 Sequence edit （编辑顺序）中的标识符编号字段。

附件总线

工具附件通过附件总线与工具相连。工具附件针对控制器上的各工具配置进行单独配置。

类型	说明
ST Selector	小显示屏和按钮用于按配置选择任务或程序。
TLS Tag	工具定位系统标签用于向操作人员提供输出信号。
EHMI	小显示屏和按钮用于按配置选择任务或程序。

附件总线配置

ST Selector

ST Selector 为工具附件。它安装在工具上并与工具附件总线相连。此外，还配有小显示屏、两个输入按钮和输出 LED 指示灯。

Display

显示屏一次显示一条信息，具有 4 个不同的页面，经配置后可在每一页显示不同的预设项。

参数	说明
第 1 页 **第 2 页** **第 3 页** **第 4 页**	从列表中选择要显示的信息： ■ 最终扭矩 ■ 最终角度 ■ 批次计数 ■ 剩余批次 ■ 通用 IO 1 ■ 通用 IO 2 ■ 通用 IO 3 ■ 通用 IO 4 ■ 通用 IO 5 ■ 通用 IO 6 ■ 通用 IO 7 ■ 通用 IO 8 ■ 通用 IO 9 ■ 通用 IO 10 ■ 所选的拧紧程序 ID ■ 所选批次序列 ID ■ 目标扭矩 ■ 目标/最终扭矩

ST Selector 显示、

切换时间

参数	说明
切换时间	选择在显示下一条讯息之前显示某条讯息的时间。

按钮

两个按钮可经配置按照显示的信息操作并用于浏览所列项。

参数	说明
左按钮	从快捷菜单选择一项操作。
右按钮	从快捷菜单选择一项操作。

ST Selector 按钮。

状态 LED

可启用或停用状态 LED。

参数	说明
启用结果 LED	选择所需的“开启”或“关闭”单选按钮。
启用附加 LED	选择所需的“开启”或“关闭”单选按钮。

ST Selector 状态 LED。

结果 LED 为红色、绿色和黄色，并显示与主工具 LED 一样的相同信息。

两个附加 LED 可以显示*批次正常*和*批次序列正常*。在进行下次拧紧时这两种 LED 熄灭。

TLS Tag

工具定位系统 (TLS) 标签为工具附件。TLS Tag 安装在工具中并与工具附件总线相连。TLS Tag 是 Ubisense 定位系统的一部分，独立于控制器进行处理。除了定位外，TLS Tag 还可向操作员提供信息。所选的输出信号可产生不同的 LED 指示灯组合。

最多可以通过 10 种不同的输出信号反映指示灯优先级。

参数	说明
信号	从快捷菜单选择触发 LED 指示灯的信号。 若为**Event**（事件）类型信号，选择信号持续时间。
颜色	选择 LED 指示灯颜色。
优先级	提供 10 种声音优先级级别，其中一(1)为最高优先级别。默认优先级别为五(5)。

TLS Tag 配置参数

若为两个同时信号，具有最高优先级的信号优先。当两个优先级相同的信号触发 LED 时，首先到达的信号优先。

输出信号既可为**Event**（事件）类型，也可为**State**（状态）类型。

只要此状态激活，则状态信号启用。

事件信号在配置的时间内启用。

EHMI

EHMI 为工具附件。它安装在工具上并与工具附件总线相连。此外，还配有图形显示、三个功能按钮并可选条形码枪。显示屏为控制器 GUI 的子设备，可以选择拧紧程序、批次序列并可查看拧紧结果。与控制器的交互通过功能按钮实现。

在 EHMI 配置中，可以决定是开启还是关闭功能按钮。

参数	说明
启用功能按钮	“开启”表示这些按钮具有在可视菜单内配置相关设置的完整功能。 “关闭”表示这些功能按钮只可用于确认 EHMI 上的必要会话。

EHMI 按钮。

配置 QIF 附件

可以将共 15 个 QIF 附件连接至单个控制器。此外，还可以向各控制器加装多个扫描器。

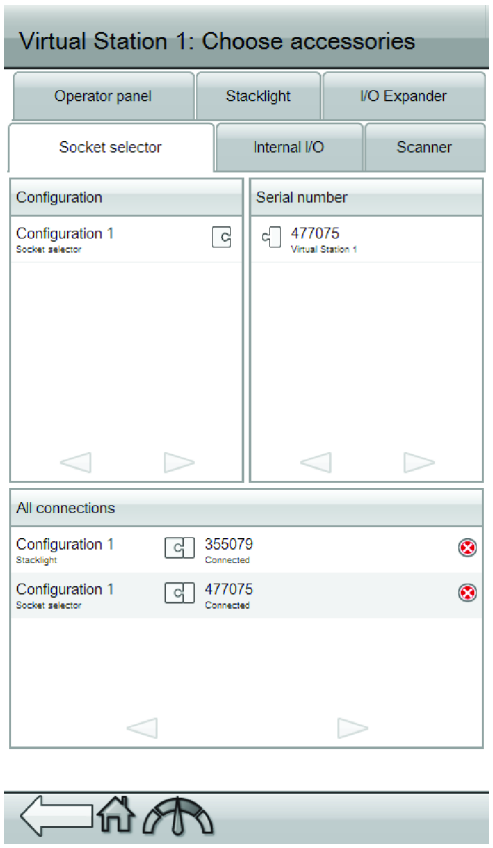
可以将与控制器相连的所有 QIF 附件连接至相同的虚拟站点。每种类型附件中一种和多个套筒选择器。

QIF 附件的功能可以连接到各个不同的输入和输出信号。

将 QIF 附件连接到虚拟站点

要将一个 QIF 附件连接到虚拟站点：

1. 在**附件**菜单中配置附件。
2. 将附件连接到控制器 I/O 总线。
3. 在**虚拟站点**菜单中选择虚拟站点，然后点击 **附件**下的**选择附件**。
4. 在适当的附件选项卡上，点击附件和配置以便进行连接。
   - 连接的附件在**所有连接**中显示。



将 QIF 附件从虚拟站点断开

要将 QIF 附件或扫描器从虚拟站点断开：

1. 在**虚拟站点**菜单中选择虚拟站点，然后点击 **附件**下的**选择附件**。
2. 在**所有连接**下，点击右侧的断开图标，即可断开。

条码枪配置

来源 > 批次 > 条码枪配置

条码枪在**来源**选项卡中配置。

条码枪用来读取条形码或者包含信息的 QR 码，从而选择相应的批次序列。

条码枪读取您指定的字符并将其组合成一串文本。该文本串与您在控制器中指定的预定义文本串匹配，如果匹配，与预定义文本串关联的批次序列会被选定。

可以读取最长由 1024 个字符组成的条形码，并且它们可以包含 ASCII 表格中 32-126 位的字符。如果条形码包含超过 1024 个字符的字符串，从位置 1025 开始往后的字符串的其余部分将被丢弃。

配置条码枪

条码枪本身必须使用美式键盘设置，随后条码枪会发出一个回车符号以终止条码字符串。

有效条码枪

如需连同 Power Focus 6000 控制器使用的、经验证的打码枪列表，请联络本地 Atlas Copco 销售代表。

选择器配置

数字输入信息

来源 > 拧紧 > 数字输入

有关连接的数字输入的信息可以进入**来源**菜单，点击**拧紧**，然后点击**数字输入**找到。

套筒选择器配置

来源 > 拧紧 > 套筒选择器

套筒选择器是一个带 LED 的套筒托盘，用来引导用户完成操作，例如，引导用户完成一个批次序列。在使用多个拧紧程序时，使用选择器非常方便。抬起套筒时，相应的拧紧程序会被选中。可以将多个套筒选择器与各虚拟站点相连。

有关连接的套筒选择器的信息可以进入**来源**菜单，点击**拧紧**，然后点击**套筒选择器**找到。

配置套筒选择器

1. 进入 Configurations（配置），然后选择 Socket selector（套筒选择器），并单击右上部的加号 (+)，创建新的配置
2. 为配置命名
3. 单击 Edit（编辑）。
4. 单击 Add（添加）或 Remove（删除），达到正确的套筒槽数，然后选择需要激活的所有套筒槽（以蓝色指示）

将一个套筒选择器连接到虚拟站点

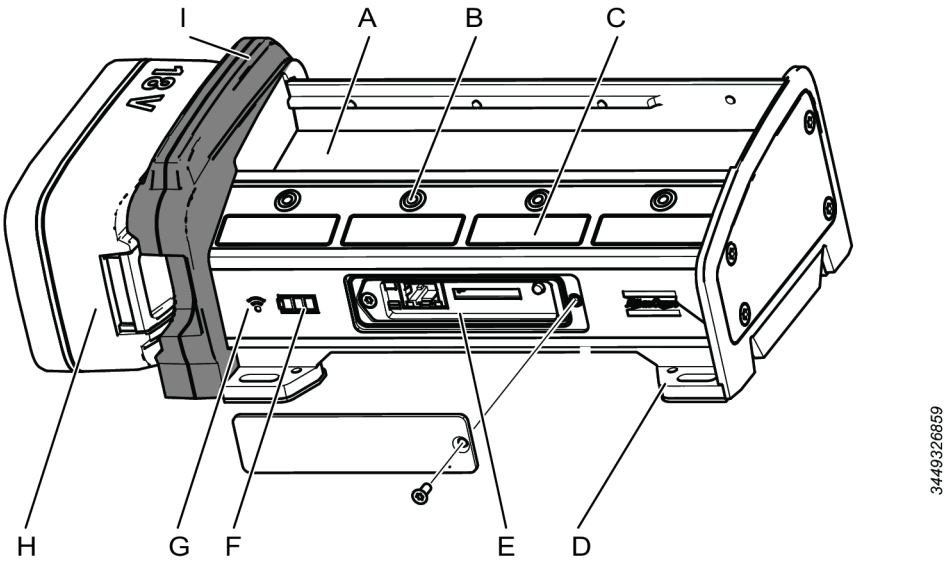
1. 在**虚拟站点**菜单中进入要使用的虚拟站点，然后进入“附件”并点击**选择附件**。
2. 在附件项下，单击“Choose accessories”（选择附件），然后进入“Socket selector”（套筒选择器）选项卡。
3. 在 *Configuration*（配置）列（左侧），选择您希望结合套筒选择器使用的配置（参见 *配置套筒选择器 [页次 99]*）
4. 在 *Connected accessories*（已连接附件）列（右侧），选择要使用的套筒选择器。

通过 I/O 总线配置套筒选择器

1. 将套筒选择器连接至控制器的 I/O 总线。
2. 在 Virtual station > Accessories > Choose accessories > Socket selector（虚拟站点 > 附件 > 选择附件 > 套筒选择器）下，检查选择器是否出现在 *Connected accessories*（已连接附件）列（右侧）

通过以太网线缆/无线配置选择器 6

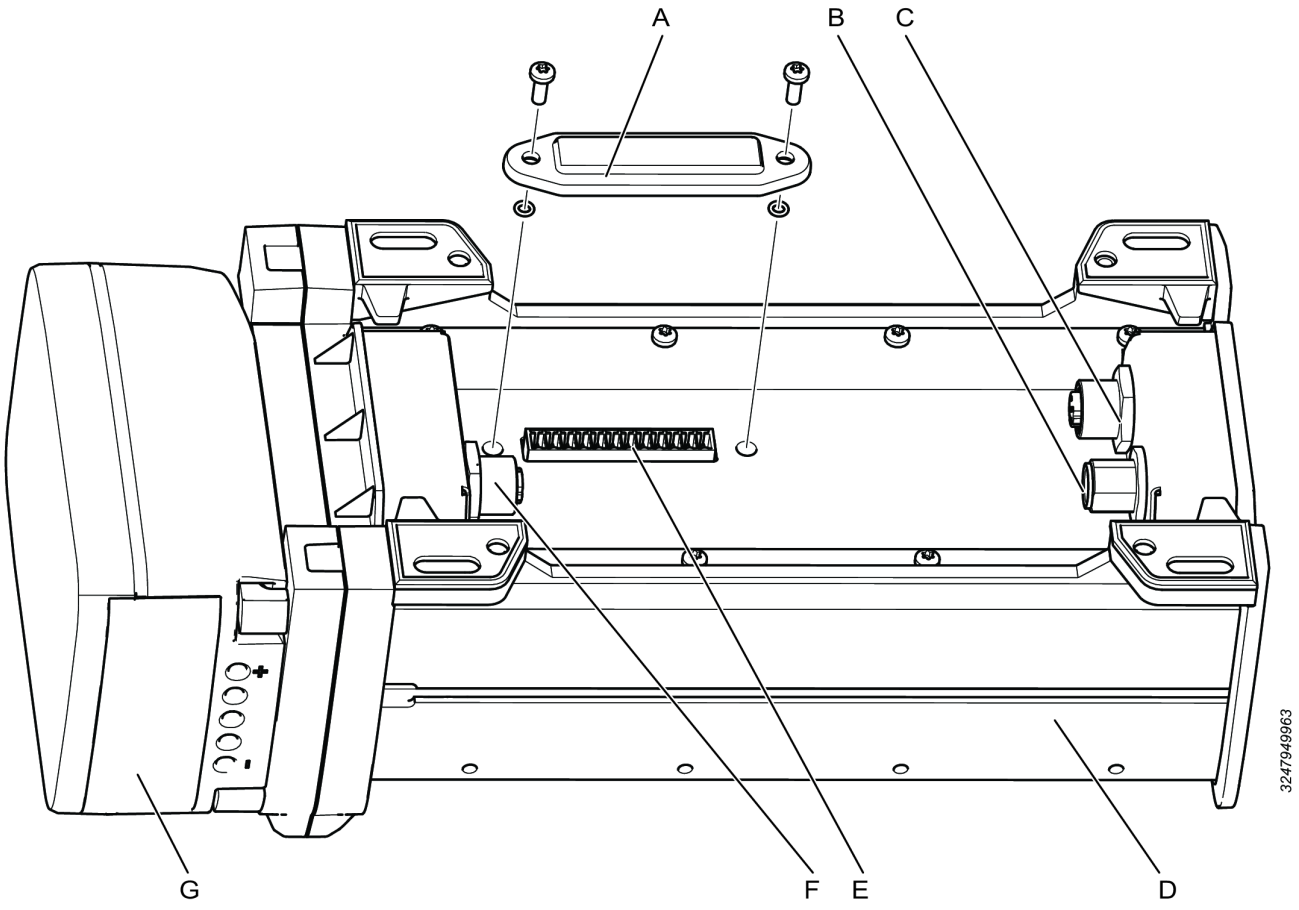
选择器 6 主要概览



选择器前视图

A	套筒或钻头支架	F	电池状态 LED（仅在无线版本上提供）
B	位置 LED 指示灯	G	WLAN 状态 LED（在部分选择器上提供）
C	标签区域	H	电池（仅在无线版本上提供）
D	每个拐角的安装孔	I	移动模块（仅在无线版本上提供）
E	服务端口		

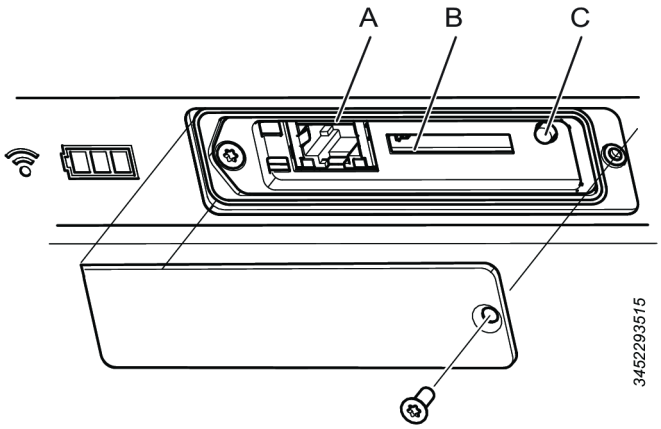
选择器 6 连接概览



选择器底视图

A	连接器盖板	E	数字输入和输出连接器
B	外部 DC 输入电源；Kycon (DC DIN) 连接器	F	以太网输出，下游连接；M12 D 编码内孔连接器
C	以太网输入，上游连接；M12 D 编码内孔连接器	G	电池
D	选择器背面		

选择器 6 服务端口概览



服务接口

A	RJ45 服务端口	C	功能按钮
B	RBU 插槽		

一般配置

1. 在控制器上，进入 **Settings** > **Network**（设置 > 网络），在 *Factory Ethernet*（出厂以太网）端口下，检查 IP 地址（在通过无线连接配置时才需要）。
2. 打开选择器上的服务端口盖。护盖通过 2 mm 内六角螺钉固定。
3. 在服务接口将以太网线缆连接到 PC 和 RJ-45 连接器之间。
4. 确保选择器通过 PoE、外部电源或电池供电。
5. 打开 PC 的 WEB 浏览器窗口。
6. 键入网络地址：169.251.1.1 并按下 **Enter**（回车）键。选择器的 WEB 服务器将响应并显示选择器 WEB 接口。
7. 选择左侧导航的 **Settings**（设置）（默认选择此项）。**Settings**（设置）工作区显示配置菜单并分为五个不同的设置：基本设置、服务端口、以太网输入、WLAN 和 PF6000。
8. 在 **Ethernet in**（以太网输入）部分，为所需的 LED 控制源选择 **External mode**（外部模式）开启或关闭。
9. 配置的接下步骤取决于套筒选择器与控制器相连的方式（以太网线缆直接与控制器相连（默认）、以太网线缆与工厂网络相连或通过无线连接至工厂网络）。请参阅以下操作说明，了解具体配置。

配置套筒选择器 - 通过以太网连接至控制器（默认）

只有新款 PF6000 型号才提供连接设备和菊链控制器的以太网端口 (RJ45)。要通过以太网线缆将选择器 6 与旧款控制器型号相连，应使用适配器线缆将以太网线缆与控制器 COM 端口相连。

1. 在 **Ethernet In**（以太网输入）部分，请在连接至下拉选项中选择 *PF6000*（默认）。
2. 单击工作区右上部的 **Save**（保存）按钮。
3. 从服务端口拔下以太网线缆。
4. 用盖子盖住服务端并用内六角螺钉固定好。

   套筒选择器出现在连接附件列表中（**Virtual station** > **Accessories** > **Choose accessories** > **Socket selector**（虚拟站点 > 附件 > 选择附件 > 套筒选择器））

配置选择器 6 - 通过线缆连接至工厂网络

1. 在 **Ethernet In**（以太网输入）部分，从连接至下拉选项中选择 *Factory net*（工厂网络）。
2. 为动态或静态 IP 地址配置选择 DHCP 开启或关闭。如果 IP 地址栏中要求静态 IP 地址，输入套筒选择器的 IP 地址。
3. 在 **PF6000** 部分，为控制器输入选择器要连接的控制器 IP 地址（参见上文）。
4. 单击工作区右上部的 **Save**（保存）按钮。
5. 从服务端口拔下以太网线缆。
6. 用盖子盖住服务端并用内六角螺钉固定好。

   套筒选择器出现在连接附件列表中（**Virtual station** > **Accessories** > **Choose accessories** > **Socket selector**（虚拟站点 > 附件 > 选择附件 > 套筒选择器））

配置套筒选择器 - 通过无线连接至工厂网络

1. 在 **Ethernet In**（以太网输入）部分，从连接至下拉选项中选择 *Factory net*（工厂网络）。
2. 在 WLAN 区域，填写以下参数：
   - 启用：将单选按钮设为“YES”（是）
   - SSID：填写套筒选择器的 SSID 名称
   - 密码：填写要连接的无线网络的密码
   - 加密类型：为无线网络选择正确的加密类型（WPA-PSK 或 WPA2-PSK、EAP-TLS）
3. 在 **PF6000** 部分，为控制器输入选择器要连接的控制器 IP 地址（参见上文）。
4. 单击工作区右上部的 **Save**（保存）按钮。
5. 从服务端口拔下以太网线缆。
6. 用盖子盖住服务端并用内六角螺钉固定好。

   套筒选择器出现在连接附件列表中（**Virtual station** > **Accessories** > **Choose accessories** > **Socket selector**（虚拟站点 > 附件 > 选择附件 > 套筒选择器））

一般虚拟站点

在一般虚拟站点中，可以保存不同的特定结果报告配置。可以创建不同的过滤器，筛选特定结果。然后，将这些配置分配到虚拟站点。

添加并编辑配置

1. 在配置菜单中，单击“General Virtual Station”（一般虚拟站点）选项卡，接着单击右上**加号**(+)。
2. 给新的配置命名并单击 **Edit**（编辑）。
3. 在报告窗口的结果筛选器中，针对您希望在结果中纳入的参数，将开关设为 **On**（开启）。默认将所有参数设为 **On**（开启）。

   可以设定以下参数：
   - 拧松
   - 批次递增
   - 批次递减
   - 重置批次
   - 忽略拧紧程序
   - 终止顺序
   - 重置批次序列

将配置分配至虚拟站点

每个虚拟站点均有之相关的独立配置，或多个虚拟站点可以共享相同配置。

1. 进入虚拟站点菜单并选择要将配置分配到的虚拟站点。
2. 在一般项下，默认选择首个一般虚拟站点配置。单击配置名称。
3. 在弹出窗口中，从列表中选择所需的配置。在选择后将关闭弹出的窗口。

拧紧结果

此部分简介如何访问 Power Focus 6000 控制器上的拧紧结果以及如何读取不同结果视图中给出的信息。其中介绍了每次拧紧后的实时结果视图和 **Reports**（报告）菜单的 **Results**（结果）中提供的历史结果视图。

执行拧紧后，结果被存储到控制器中。也可使用 *导出功能 [页次 111]*，将结果发送至诸如 ToolsNet 之类的外部系统或导出供分析。

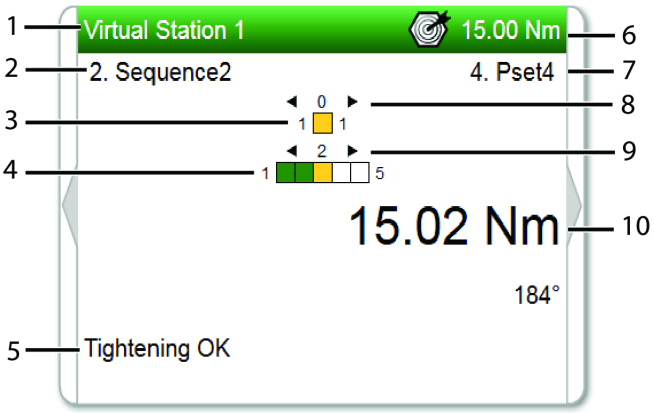
实时结果

实时结果窗口显示来自控制器上不同虚拟站点的结果，上部四个窗格，下部四个窗格。这是因为可针对同一个虚拟站点选择两个不同的结果视图同一时间显示。

轻敲结果面板打开一个窗口，您可以通过单击结果窗口侧面的箭头来查看不同的结果视图。

结果视图 – 数字

第一个窗口显示结果数字。



1. 虚拟站点名称
2. 批次序列名称
3. 顺序中的批次
   - OK 批次为绿色。
   - 正在进行批次为黄色。
   - NOK 批次为红色。
4. 批次中的拧紧
   - OK 拧紧为绿色。
   - 正在进行拧紧为黄色。
   - NOK 拧紧为红色。
5. 结果状态

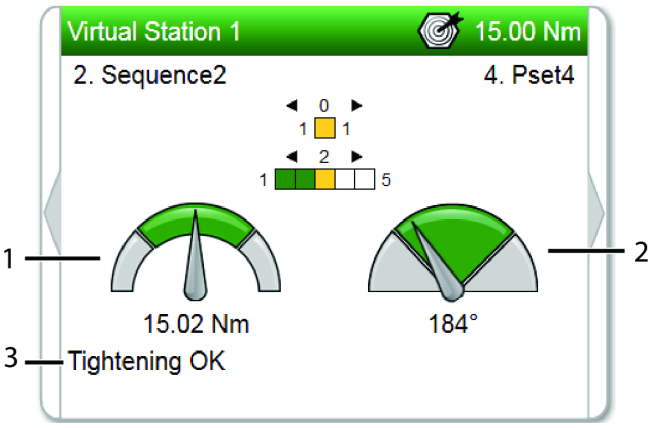
   NOK 拧紧会给出未成功拧紧的详细状态。
6. 目标扭矩/角度
7. 拧紧程序名称
8. 顺序中已完成的批次数目
9. 批次中已完成的拧紧次数
10. 拧紧结果

结果视图 – 高-低结果

该图示显示结果是高于、低于设定限值还是在设定的限值范围内。

1. 图示显示拧紧结果相对于给定的拧紧程序限值是过高还是过低。扭矩值。
2. 角度值
3. 结果状态

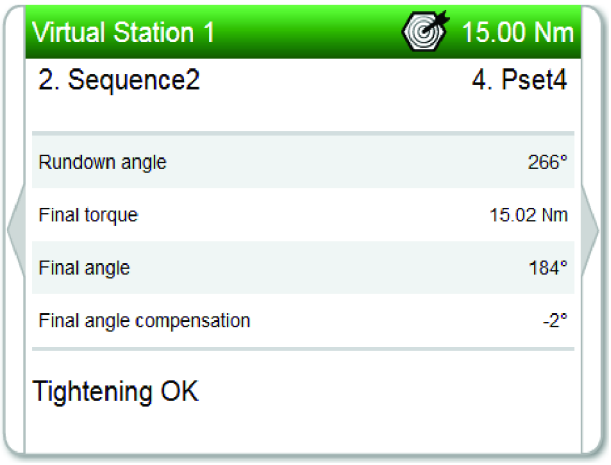
   如果拧紧 NOK，则会给出详细的原因。请参阅 *NOK 结果的状态 [页次 106]*一节。

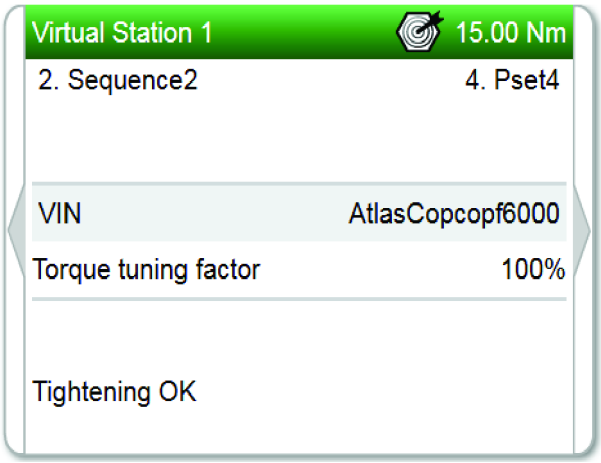


结果视图 – 扩充结果

扩充结果视图会显示一些额外的拧紧结果。

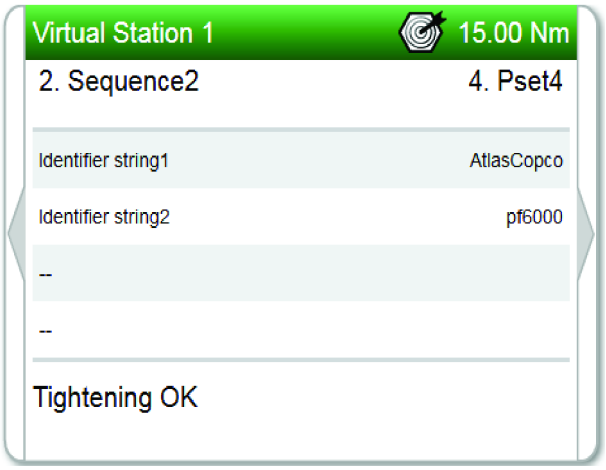
第二个视图始终显示标识符(VIN)。如果第一个屏已被参数占满，则其余参数显示在第二屏中。





结果视图 – 标识符字符串

结果视图显示多个条形码扫描中包含的标识符字符串。

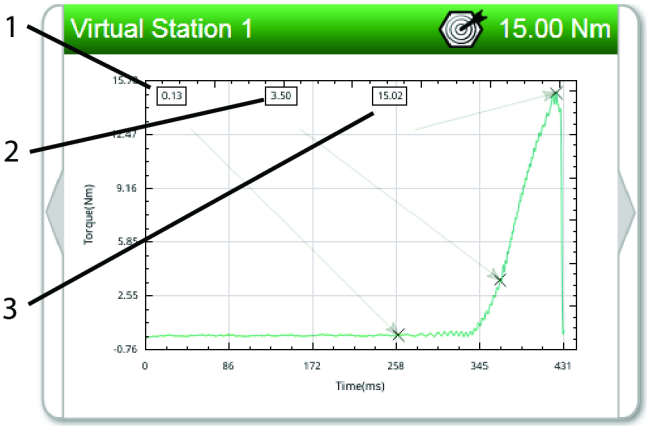


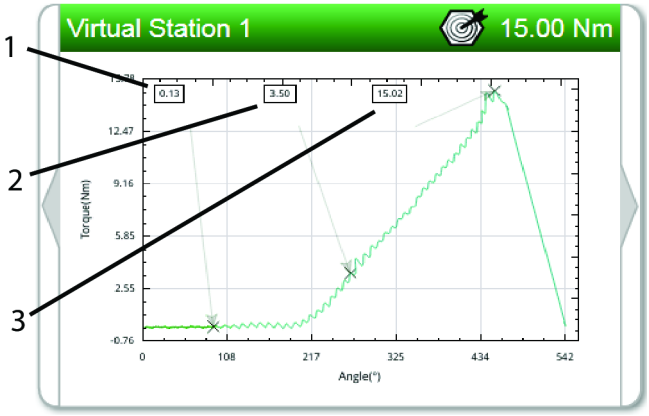
结果视图 – 跟踪

在绘制图结果视图中，可更好地了解拧紧行为，以对拧紧程序进行调整。根据拧紧策略，绘制图将显示不同的拧紧参数。

跟踪结果能够以两种不同的图形呈现：扭矩/时间和扭矩/角度。

1. 软启动
2. 旋入完成
3. 最终扭矩



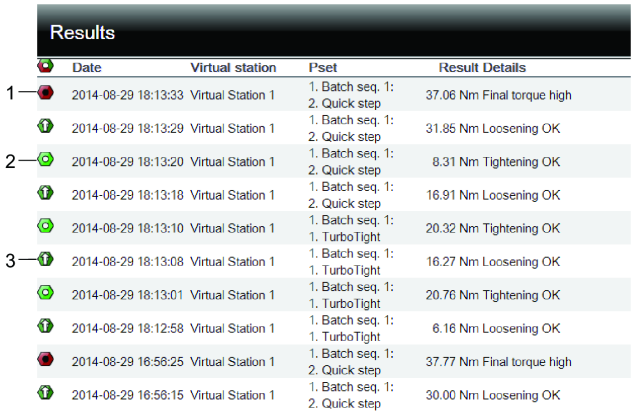


存储的结果

控制器会存储所执行的每次拧紧或拧松的结果。单击某个结果将会显示与*实时结果 [页次 103]*中所描述的结果窗口相同的窗口。结果列表将显示关于以下内容的信息：

- 日期 – 执行拧紧的日期和时间。
- 虚拟站点 – 执行拧紧所用的虚拟站点。
- 拧紧程序 – 拧紧程序或批次/拧紧程序。
- 结果详情 – 扭矩或角度结果，以及结果状态。

1. NOK 拧紧
2. OK 拧紧
3. OK 拧松



拧紧错误报告

将会报告错误，例如由于未正确执行拧紧或者结果与设置限值和目标值不符等。错误消息显示在屏幕上。

报告错误时，可能为一个错误或同时发生了几个错误。由于控制器存储错误报告的空间有限，一次只能显示一个错误。因此，错误将以优先顺序列表形式存储，始终显示要终止的最先错误。

NOK 结果的状态

有关 NOK 警告及其说明的完整列表，请参见*事件 NOK 结果列表 [页次 123]*

系统管理

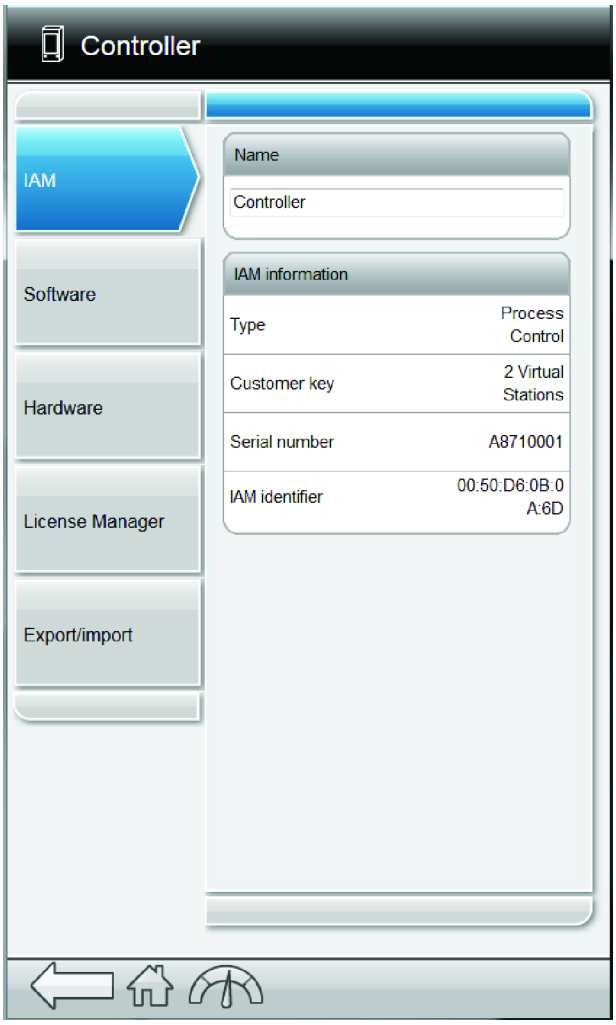
有关 Power Focus 6000 控制器的系统管理任务，请通过 **Controller**（控制器）菜单处理。可以通过 GUI、WEB GUI 或 Tools Talk 2 GUI 访问菜单。

IAM

控制器 > IAM

智能应用模块（IAM）是控制器中的非易失性存储。存储模块包括所有控制器程序、配置和结果。某些模块还可能包括额外加载的*功能项*。

有关可用 IAM 及其功能的完整列表，请咨询 Atlas Copco 销售代表。



IAM 信息

硬件

控制器 > 硬件

硬件选项卡包含型号名称、序列号、触摸屏校准等控制器信息，以及控制器中各种电子板的信息。

健康状态

健康状态视图包含有关电池状态和控制器温度的信息。

控制器电池

PF6000 电池位于控制器前板内，用作部分系统元件（如内部时钟）的备用电源。电池状态每天及在控制器重启时都会更新一次。当电池电量接近完全耗尽时，将显示一条警告信息(3011)。在弹出警告信息时，应尽快更换电池。

1. 单击控制器
2. 单击硬件
3. 控制器电池状态列在健康状态下。

控制器温度

控制器温度由 PF6000 持续监控。受支持的温度单位为摄氏度(° C)和华氏度 (° F)，默认单位为摄氏度。可以在两个单位之间切换，而无需重启控制器。当控制器温度超过最大温度时，停用驱动级并将显示一条警报(3010)。当控制器温度低于温度限值时，会再次启用驱动级。

用户通过显示器或 Web GUI 可以查看最近测量的控制器温度，以及测量时的具体时间。

1. 单击控制器
2. 单击硬件
3. 控制器温度列在健康状态下

软件

控制器 > 软件

有关在 Power Focus 6000 控制器中提供的两个软件版本的版本号，请在软件选项卡下查看。

在多个控制器上执行升级时，安装另一个版本的控制器软件会比较有用。当生产准备切换到升级的软件时，既可通过控制器 GUI 在本地激活新的软件版本，也可通过带 WEB GUI 或装有 Tools Talk 的远程计算机激活新的软件版本。

通过将存储有软件的 USB 闪存驱动器连接到控制器的 USB 端口，或通过使用 WEB GUI，可以安装新版软件。

软件更新选项只有在通过 PC 访问控制器 GUI 时可见。在将装有有效软件版本的大容量存储设备插入 USB 端口时，会弹出更新软件的提示信息。

软件更新文件不得解压缩，并且必须存储在 U 盘根目录下名为 **PFImages** 的文件夹中。

更新软件版本不会传输控制器配置或拧紧程序。

通过 USB 接口更新控制器软件

从 U 盘安装软件：

1. 当 U 盘连接到控制器时，安装向导会自动启动。如果 U 盘中有几种可用软件版本，将显示一个包含不同软件升级文件的列表。
2. 选择软件升级文件进行安装，然后遵循说明完成安装。

USB 闪存盘需具有一个可用的分区并进行格式化，以供 Linux 运行使用。可能的格式类型有 FAT 或 NTFS。

通过 WEB GUI 更新控制器软件

从 WEB GUI 安装软件：

1. 在**控制器**菜单中，进入**软件**，然后选择 **软件更新**并单击**浏览**。
2. 浏览并选择软件压缩文件，并按照说明完成安装。

软件激活

控制器可存储两种安装的软件版本。通过使用“软件激活”，可选择要使用哪种软件版本。既可通过控制器 GUI 在本地激活软件，也可通过 WEB GUI 远程激活软件。

激活过程需要重新启动控制器。

要激活安装的软件，请执行以下操作：

1. 在**控制器**菜单中，进入**软件**。

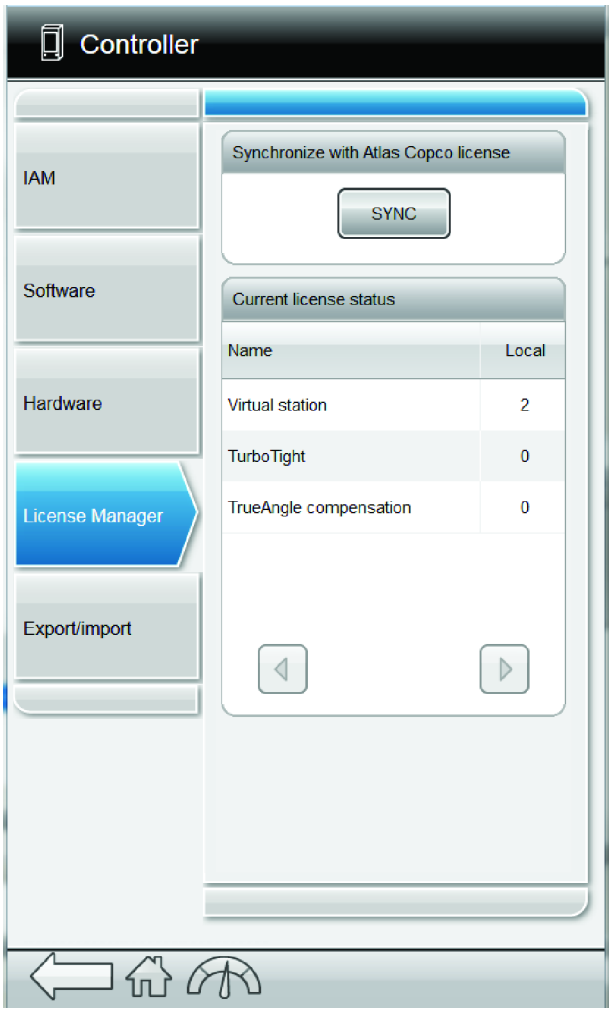
2. 触摸 **软件激活**开关以便进行存储并遵循说明操作。

许可管理器

控制器 > 许可管理器

在使用 IAM 时，可以通过依靠 Tools Talk GUI 处理的许可服务器安装与之兼容的 *TurboTight* 和 *TrueAngle compensation*（TrueAngle 补偿）等许可或获许可的功能。此外，还可通过 USB 闪存盘安装许可证。

分配给 Power Focus 6000 控制器的许可证可在许可管理器选项卡下的列表中查看。



许可信息

功能管理系统介绍

在通过动态许可方案需要附加功能时，**Functionality Management System**（功能管理系统，FMS）将允许 Atlas Copco 客户使用所需的其他功能。

在完成业务交易时，**Atlas Copco License Portal**（Atlas Copco 许可证门户网站，ACLP）中的客户帐户在 24 小时内会自动接收到所购功能并可以许可证文件的形式下载这些功能。

将此功能文件（包含在许可证协议中）加载到 **Local License Server** （本地许可证服务器，LLS），在此进行解码并进行分配。

随之创建可以在许多控制器中使用的*功能项*池。在需要时，可以将所需的功能项上传至控制器；当不再需要时，功能项会自动回到功能池。

在 Atlas Copco 许可证门户网站（ACLP），可以管理具有所有功能项、权限的帐户并从许可证服务器返回许可证或将其返回至许可证服务器。

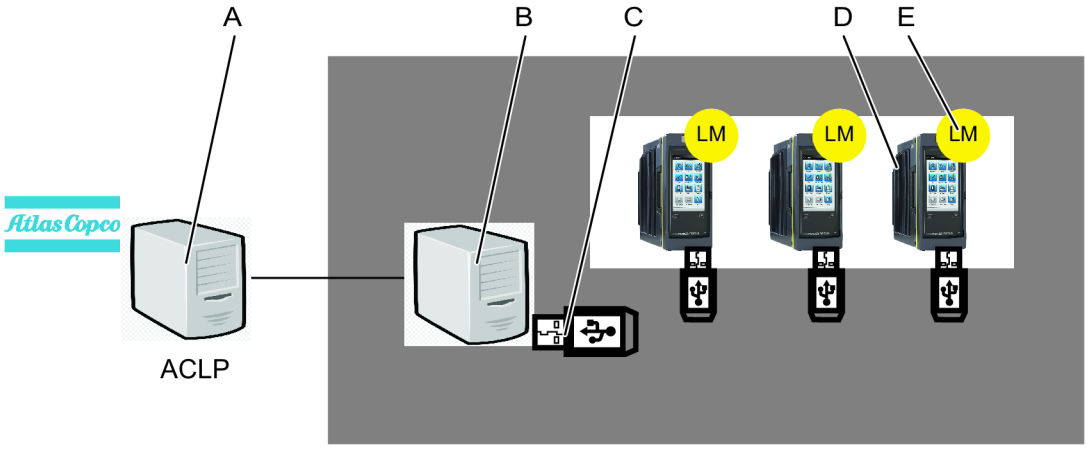
本文件不涉及在 ACLP 中创建和管理客户帐户。

功能管理系统 – 手动分配功能项

每个控制器都有一个**许可证管理器** (LM)。

控制器的许可管理器负责处理*功能项*并在控制器和 USB 设备之间传输。

USB 闪存盘是许可证分配服务器。其存储器的一部分用作受信任的存储区，其中包含*功能项*池。需要时，在将 USB 设备插入控制器后，许可管理器可从服务器加载*功能项*。当不再需要时，功能项会回到服务器池。



采用手动分配架构的功能管理系统

A	**Atlas Copco 许可证门户网站**	B	客户办公场所的计算机，可以通过互联网与外部服务器进行通信。
C	USB 闪存盘 - 功能分配服务器。	D	控制器
E	控制器内的**许可管理器**		

此图仅显示 FMS 及*功能项*的分发。出于其他原因，控制器可与网络相连。

使用许可传送器的 FMS 流程如下：

1. 客户从 Atlas Copco 订购所需的*功能项*。
2. 在完成业务交易时，客户可从 **Atlas Copco License Portal**（Atlas Copco 许可证门户网站，ACLP）下载*功能项*或以其他方式接收文件。将功能文件载入在此完成解码的**本地许可证服务器**（LLS）。随之创建可以在许多控制器中使用的*功能项*池。
3. 许可文件从计算机传输至 USB 闪存盘的通用存储区。
4. 从计算机中删除 USB 闪存盘并将其插入支持 FMS 的控制器。
5. 控制器的许可管理器读取整个文件，在完成文件解码后，将其从通用存储区删除，同时将内容传输至 USB 闪存盘的受信任存储区。现在，受信任的存储区包含可以在许多控制器中使用的*功能项*池。
6. 许可管理器可以将*功能项*从分配服务器迁移至控制器，或在不再需要时将*功能项*从控制器移至分配服务器。
7. 将 USB 设备从控制器删除并移至下一个要求做出功能变更的控制器。

如果需要更多的*功能项*，可以从 Atlas Copco 订购并下载新的文件。

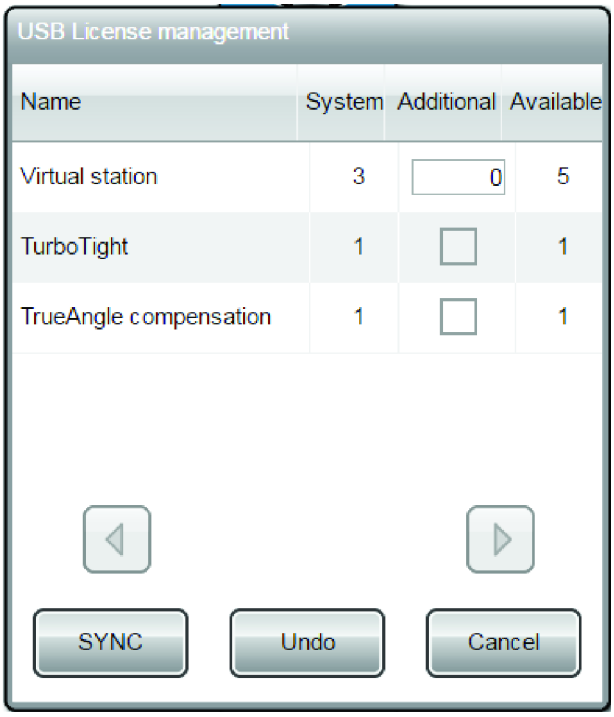
USB 闪存盘

功能管理系统（FMS）使用专门的 USB 设备从控制器或向控制器传输功能。

USB 闪存盘包含通用存储区和仅可通过控制器的**许可管理器**访问的受信任存储区。

将从 Atlas Copco 购买的*功能项*下载到通用存储区。首次将 USB 设备插入含 **License manager**（许可管理器）的控制器时，系统将检测文件并进行解码，同时将*功能项*传输至仅可通过**许可管理器**访问的受信任存储区。

USB 设备不仅可用作通用存储驱动器，而且还可作为采用受信任存储的分配服务器。



在插入 USB 设备时控制器上的窗口随之打开。

如果将 USB 闪存盘用作分配服务器，则不得使用网络分配服务器。任何试图使用多个分发服务器的尝试都可能导致*功能项*永久丢失。

导出/导入配置

控制器 > 导出/导入

导出和导入功能用于在**Reports**（报告）菜单中导出事件和拧紧结果，以供在外部程序中进行分析，以及能够在控制器之间传送拧紧程序、批次和控制器配置。

导出功能用于：

- 从线缆工具及连接的无线工具导出拧紧结果和事件，以供进一步处理。
- 导出日志文件，以用作 Atlas Copco 服务工程师的调试援助。
- 导出可用于将设置复制到另一个控制器的控制器配置

从控制器中导出何种内容存在三种选择：**所有控制器信息**、**设置和配置**以及**来自连接工具的日志**。设置和配置选项仅导出相关设置且执行时用时较小。所有控制器信息、设置和配置均不包含连接工具上的信息。

当前，仅可导出 STB、SRB 和 TBP 工具的工具日志。

在使用导入功能时，拧紧程序、批次、附件和控制器的所有设置都将更新为导入文件的设置。但是，不会导入网络、PIN 以及结果和事件的设置。

在从控制器 GUI 中导出文件时，确保将正确格式的 USB 存储设备连接至控制器的 USB 端口，这是因为此为存储所导出文件的存储区。在从 WEB GUI 导出文件后，将存储在浏览器的下载区。注意：在控制器未连接工具的情况下，当选择“来自连接工具的日志”选项时，仍将导出一个文件。此文件不包含任何信息。

导出的信息和文件格式

导出的文件

导出的文件是一个压缩文档，其中包含一个具有相关设置的二进制文件，以及两个包含结果和事件的字符分隔值（csv）文件。

在选择设置和配置后，不会将包含结果或事件的文件导出到数据文档。

文件	说明
PFExport__<Controller name>_<Time stamp>_Events.csv	以分号分隔的文件，其中包含以下信息： ■ 严重性：事件的类型 ■ 日期和时间：事件发生时的时间戳 ■ 代码：事件 ID ■ 描述：对事件的简短描述 ■ 虚拟站点：虚拟站点 ID
PFExport__<Controller name>_<Time stamp>_Results.csv	以分号分隔的文件，其中包含以下信息： ■ 拧紧类型：多工具、单工具、单工具批次或多工具批次。 ■ 虚拟站点名称 ■ VIN：车辆识别码 ■ 日期和时间：结果发生时的时间戳 ■ 批次序列名称：批次序列名称 ■ 批次序列计数器：批次序列中的批次编号 ■ 批次计数：批次中的实际拧紧次数 ■ 螺栓名称 ■ 状态：拧紧或拧松状态 OK 或 NOK ■ 状态附加信息：对结果状态的简短描述 ■ 拧紧程序名称 ■ 目标扭矩：目标扭矩值 ■ 最终扭矩：最终的扭矩值 ■ 目标角度：目标角度值 ■ 最终角度：最终的角度值 ■ 旋入角度：旋入角度值 ■ 扭矩调整因数：在使用 TurboTight 时补偿剩余扭矩和动态扭矩之间差值的因数。 ■ 切断时电流 ■ TrueAngle 补偿 ■ 旋入完成时间 ■ 达到最终扭矩时间
ExportInfo.txt	关于控制器设置和控制器软件的信息。
settings/settings.bin	一个包含所有拧紧程序和批次设置、附件配置和控制器设置的二进制文件，例如：语言、扭矩单位、现场总线数据、日期和时间，以及结果视图。

导出的信息

导出的 csv 文件格式

导出的 csv 文件使用不同的字符分隔各个字段，具体字符情况取决于语言设置。有关详情，请参见下表。

语言	日期/时间	字段分隔符	数字格式
英语 (en_US)	MM/dd/yyyy hh:mm:ss	,	123.456
捷克语 (cs_CZ)	dd.MM.yyyy hh:mm:ss	;	123,456
德语 (de_DE)	dd.MM.yyyy hh:mm:ss	;	123,456
西班牙语 (es_ES)	dd/MM//yyyy hh:mm:ss	;	123,456
法语 (fr_FR)	dd/MM/yyyy hh:mm:ss	;	123,456

语言	日期/时间	字段分隔符	数字格式
韩语 (ko_KR)	yyyy-MM-dd hh:mm:ss	,	123.456
意大利语 (it_IT)	dd/MM/yyyy hh:mm:ss	;	123,456
日语 (ja_JP)	yyyy/MM/dd hh:mm:ss	,	123.456
葡萄牙语(pt_BR)	dd/MM/yyyy hh:mm:ss	;	123,456
俄语 (ru_RU)	dd.MM.yyyy hh:mm:ss	;	123,456
瑞典语 (sv_SE)	yyyy-MM-dd hh:mm:ss	;	123,456
中文 (zh_CN)	yyyy/MM/dd hh:mm:ss	,	123.456

以不同语言表示的日期格式

从 WEB GUI 导出或导入

当从 WEB GUI 使用此功能时，系统将显示一条选择保存或检索导出文件位置的提示信息。

从控制器导出或导入

当从控制器 GUI 使用此功能时，必须连接 USB 闪存盘，才能导出和导入数据。

需要格式化 USB 闪存盘并为 Linux 运行提供分区。可能的格式类型有 FAT 或 NTFS。

在控制器间导出和导入

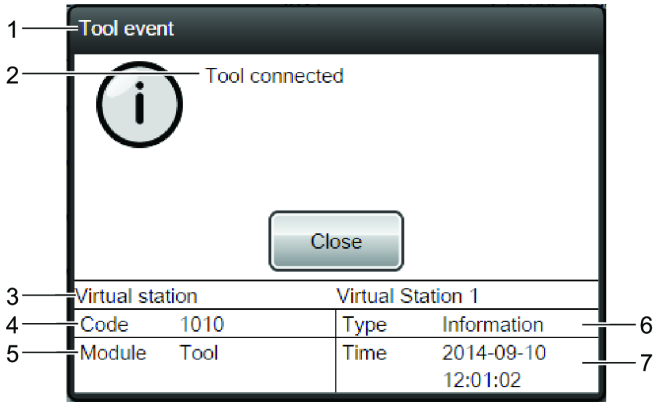
控制器可能具有不同类型的 IAM 模块，这些模块支持不同数量的拧紧程序、批次或虚拟站点。
控制器可以导出适用于当前类型 IAM 模式的所有配置。

控制器无法导入从不同类型 IAM 模式中导出的文件。这同样适用于使用 ToolsTalk 的情况。

事件

阅读事件中给出的信息

事件包含描述已发生事件的信息以及部分系统信息，用于辅助描述何时何地发生什么事件。



事件信息窗口

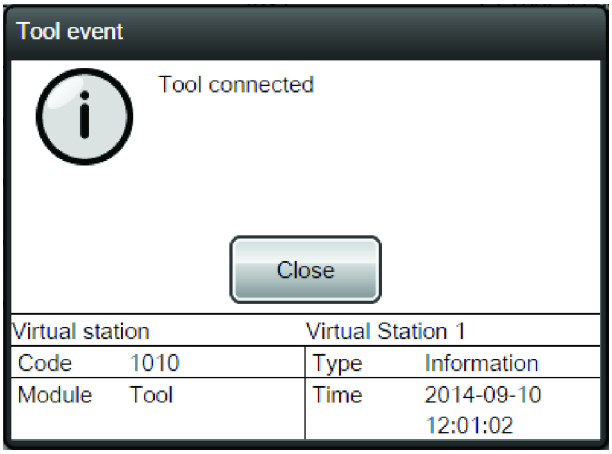
1. **Heading**（标题） – 描述事件发生在系统的哪个部分。
2. **Event name**（事件名称） – 对事件进行的简短描述。
3. **Virtual station**（虚拟站点） – 如果事件与控制器的虚拟站点有关，将会显示虚拟站点名称。
4. **Code**（代码） – 具有唯一性的四位数字编号，用于区分事件。
5. **Module**（模块） – 描述事件发生在系统的哪个部分。
6. **Type**（类型） – 信息、警告或错误。
7. **Time**（时间） – 事件发生的日期和时间。

时间类型

事件分成三类；信息、警告和错误。

信息事件

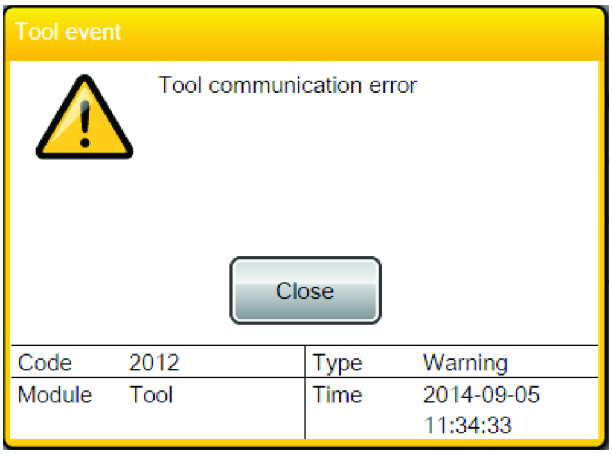
信息事件指的是，因用户或系统执行的动作而发生的引人注目的事件。信息事件不需要用户采取任何特殊行动。



信息事件

警告事件

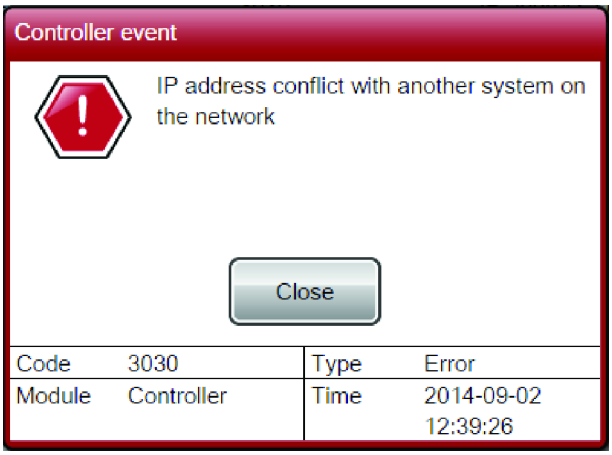
警告事件表示可能影响系统性能或导致人员受伤的潜在严重状况。



警告事件

错误事件

警告事件表示中止运行之类的严重状况，几乎全都需要用户对设置或配置进行更改才能继续。



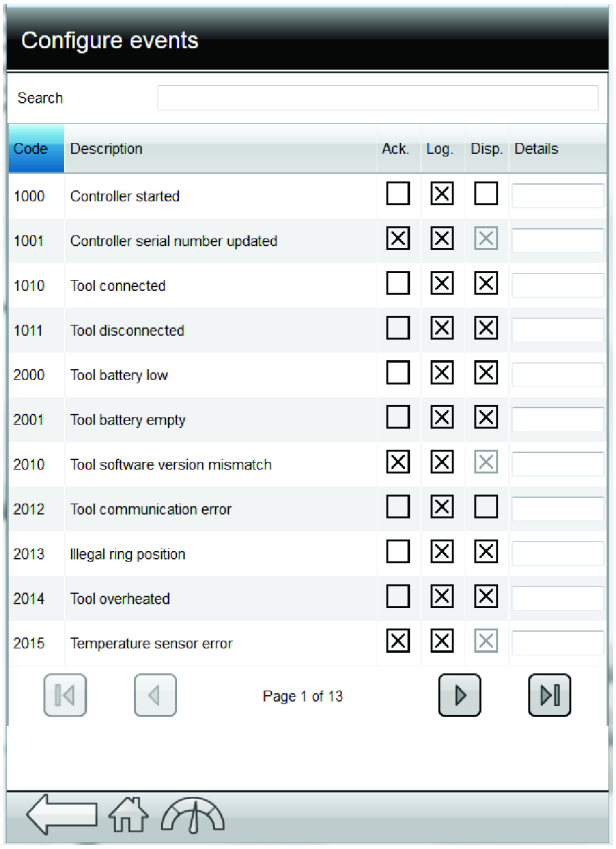
错误事件

配置事件

设置 -> 事件

部分选项无法更改且以灰色显示。

每个事件均有默认设置，规定其是否应该确认(Ack)、记录(Log)或显示(Disp)。这些设置可在 **Settings**（设置）菜单的 **Events**（事件）中配置。



事件列表

Power Focus 6000 的事件代码

事件用于通知用户，系统中某些状态发生变化或出现某些状态。它们的类型不同，需要采取不同的行动处理。

上述的部分过程只能由 Atlas Copco 授权的服务提供商执行。

事件代码	组	说明
1000-1999	控制器，工具	控制器和工具事件。
2000-2999	工具	工具事件。
3000-3999	控制器、驱动器、通道、配置	控制器与驱动器事件，以及步骤同步事件。
4000-4999	过程	拧紧过程事件。
5000-5999	配置	程序配置事件。
6000-6999	配件	配件事件。
7000-7999	消息	消息。

表格标题	说明
事件代码	唯一事件编号。
类型	事件类型： ■ 信息 ■ 警告 ■ 错误
名称	事件的描述性名称。

表格标题	说明
说明	对事件及其发生原因的简短描述。
程序	如果适用，步骤中会包含关于如何清除事件的说明。
A - 确认	告知用户该事件是否需要确认，然后才能继续。此列表中的值为默认值。
L - 记录	告知用户该事件是否要保存在事件日志中。此列表中的值为默认值。
D - 显示	告知用户该事件是否要显示在屏幕上。此列表中的值为默认值。

事件代码	类型	名称	说明	程序	L	D	A
1000	信息	控制器已启动	控制器已启动。	不适用	X		
1001	警告	控制器序列号已更新	如果 IT 板盒序列号（控制器序列号）不同于 AUX 板盒序列号，会在启动时生成。AUX 板盒在现场视为不可替代。控制器在更新序列号时将会重启。	更换 IT 板或盒。	X	X	X
1010	信息	工具已连接	工具已连接。	不适用	X	X	
1011	信息	工具已断开	工具已断开。	不适用	X	X	
2000	警告	电池电量低		更换电池。	X	X	
2001	警告	电池电量用完		更换电池。	X	X	
2009	警告	备份电池电压低	控制器备份电池电量几乎耗尽	更换电池	X	X	
2010	错误	工具软件版本不匹配	工具和控制器软件版本不兼容。	请对工具进行维修 - 更新工具软件。	X	X	X
2012	警告	工具通信错误	工具和控制器之间的通信中断。	重新定位天线布置。	X		
2013	警告	方向选择环位置错误	工具方向开关位于故障位。	如果频繁出现 - 请对工具进行维修。	X	X	
2014	警告	工具过热	工具过热。		X	X	
2015	错误	工具温度传感器错误			X	X	
2020	警告	工具需要电机调谐	工具需要电机调谐。	执行电机调谐。	X	X	
2021	警告	电机调谐失败	电机调谐失败。	完成电机调谐或请对工具进行维修。	X		
2022	信息	电机调谐完成	电机调谐完成。	不适用	X		
2023	警告	工具需要开口端调整	工具需要开口端调整。	执行开口端调整。	X	X	
2024	警告	开启开口端失败	开启端调整失败。	尝试再执行一次开头端调整。如果又失败了，请对工具进行维修。	X		
2025	信息	开启开口端成功	开口端调整成功。	不适用	X		
2026	警告	开口端失败	开口端位置失败。	再次按下触发器，并等待定位完成。如果又失败了，请对工具进行维修。	X	X	
2030	错误	工具内存损坏	工具存储器损坏。	维修该工具。	X	X	X
2031	错误	工具附件内存损坏	工具附件存储器损坏。	维修工具附件。	X	X	X
2040	错误	系统检查失败			X	X	X
2041	错误	扭矩传感器错误	校准错误或工具报告传感器错误时会生成该错误。	维修该工具。	X	X	

事件代码	类型	名称	说明	程序	L	D	A
2042	错误	角度传感器错误		维修该工具。	X	X	X
2043	错误	工具接地故障报错			X	X	X
2044	信息	工具保养间隔已过	表示需要对工具进行保养。超过设定的拧紧数时触发。	执行工具维修。	X	X	
2045	警告	工具校准数据无效	如果校准数据验证失败。	维修该工具。	X	X	
2046	信息	工具校准指示符	表示需要进行工具校准。在设置中启用校准警报并且当前时间大于下次校准日期时，会触发校准工具。	维修该工具。	X	X	
2047	信息	自动更新服务数据校验和	指示已自动更新服务数据校验和。	不适用	X	X	
2050	错误	工具参数文件不受支持	所需的工具参数缺失。	更新工具参数。	X	X	
2060	信息	意外触发方式	用于防止连接了附件的工具启动。	不适用	X	X	
2070	信息	工具不受支持	工具没有许可证/不受支持。	不适用	X	X	
2071	错误	工具内存损坏	工具描述符已损坏。	维修该工具。	X	X	
2072	信息	未知的设备已连接			X	X	
2073	警告	工具触发器监管失效	HW 通道故障。工具触发器的硬件监管和软件监管不匹配。		X	X	
2074	警告	工具标识电路板故障	工具标识电路板故障。	维修该工具。	X	X	
2075	警告	工具风扇电压故障	工具风扇电压故障。	维修该工具。	X	X	
2076	警告	工具附件总线电压故障	工具附件总线电压故障。	维修该工具。	X	X	
2077	警告	工具触发器传感器错误	工具触发器传感器错误。	维修该工具。	X	X	
2078	信息	工具拧紧程序已更新			X	X	
2079	错误	工具线缆不受支持	工具线缆已损坏。线缆的插头不对应或已受损。	切换线缆。	X	X	
2080	错误	工具电池故障	直流电压太高或太低。电池故障。	联系 Atlas Copco 服务代表并将电池送回 Atlas Copco（不得重复使用！）。	X	X	
2081	错误	达到工具电流限值	达到电流限值且驱动装置会被禁用。	维修该工具。	X	X	
2082	错误	工具电流测量值有误差	电流测量值有误差。无法测得可靠的电流结果。	维修该工具。	X	X	
2083	错误	工具内部错误	各种 STB 内部硬件错误。	维修该工具。	X	X	
2084	错误	工具内部软件错误	各种 STB 内部软件错误。	维修该工具。	X	X	
2085	错误	工具 RBU 错误	工具软件检测到 RBU 错误。	检查当前是否安装了 RBU。如果错误仍然存在，请对工具进行维修。	X	X	
2086	错误	工具停转	工具电机停转。	维修该工具。	X	X	

事件代码	类型	名称	说明	程序	L	D	A
2093	警告	脉冲单元油位低	所连接脉冲工具的油位低。	维修该工具	X	X	
2094	警告	脉冲单元油位空	所连接脉冲工具的油位低于所需的工作油位	维修该工具	X	X	X
2100	信息	删除了 smartHead	已删除 STwrench smartHead。	重新连接 smartHead 并重启扳手。	X	X	
3000	错误	控制器内部软件错误	控制器软件错误。	联系服务人员。	X	X	X
3010	警告	系统过热	控制器过热。	降温。	X	X	
3020		控制器硬件故障					
3021	警告	系统电压问题	直流电压太高或太低。	不适用	X	X	
3030	错误	IP 地址与网络上的另一个节点冲突	设置的 IP 地址已经被同一网络上的其他设备占用。	更改其中一个设备的 IP 地址。	X	X	
3031	信息	网线断开	工厂端的载体已丢失。	检查线缆连接。	X	X	
3032	信息	射频配对已开始	工具配对已启动。	不适用	X	X	
3033	信息	无线电配对成功	工具配对成功。	不适用	X	X	
3034	错误	射频配对失败，未找到任何工具	扫描射频点时未发现任何可与控制器配对的工具。	将工具设为配对模式并重试。	X	X	
3035	错误	无线电配对失败，检测到不止一个工具	扫描射频点时，控制器找到的工具多于一个	控制器开始配对模式时，应确保只有一个工具处于配对模式下。	X	X	
3036	错误	与工具通信时，射频配对失败	配对过程中，发生控制器连接中断、意外的应答或超时问题。	再次尝试执行配对。如果又失败了，请对工具进行维修。	X	X	
3040	警告	紧急停止	因紧急停机，驱动装置被禁用。	重置紧急停机。	X	X	
3050	信息	系统时钟已更新	系统时钟已更新。	不适用	X		
3051	错误	系统时钟错误	实时时钟 (RTC) 硬件的时间读数错误。	更换 RTC 的电池。	X	X	X
3052	警告	远程启动配置出错	HW 与 SW 的远程启动配置不匹配。	检查并校验 HW 指拨开关是否与选定启动来源相匹配。	X	X	
3059		连接 Atlas Copco 许可证管理器失败	表明控制器未能连接到本地许可证管理器来获得许可证。	查看本地网络。如果再次失败，请对控制器进行维修。	X	X	
3060		虚拟站许可证超出的数目	表明使用中的虚拟站数目大于虚拟站实际许可数目。	删除无许可证的虚拟站或联络本地许可证服务器来获取更多许可证。	X	X	X
3500	错误	许可管理器一般错误			X	X	X
3501	错误	许可管理器同步错误			X	X	X
3502	信息	许可管理器同步已完成			X		
3520	警告	TurboTight 未获许可	TurboTight 许可不可用。	检查许可证。	X	X	

事件代码	类型	名称	说明	程序	L	D	A
3521	警告	真的角度未获许可	TrueAngle 许可不可用。	检查许可证。	X	X	
4010	信息	工具被数字输入锁住	通过数字输入信号锁定工具。	不适用	X	X	
4011	信息	工具被开发协议锁定	通过开放协议锁定工具。	不适用	X	X	
4012	信息	工具被现场总线锁定	通过现场总线锁定工具。	不适用	X	X	
4015	信息	拧松被禁用	在拧紧程序中禁用拧松		X	X	
4016	信息	拧紧已禁用			X	X	
4020	信息	NOK 拧紧过多	超过了批次中的最大持续 NOK 拧紧		X	X	
4025	信息	未选择拧紧程序	未选择拧紧程序。	选择拧紧程序或批次序列。	X	X	
4030	信息	批次顺序取消			X	X	
4031	信息	完成批次序列所需的最大时间。			X	X	
4032	信息	完成首次拧紧所需的最大时间。			X	X	
4035	信息	通过线路控制锁定			X	X	
4040	信息	经备用标识符锁定	工具被备用标识符锁定。		X	X	
4050		无效的套筒配置			X	X	
4060	信息	工具在批次完成时锁定	当批次序列完成时借助标记工具锁定批次时，本事件会在用户按下触发器时生成。	在完成时采用信号解锁工具解锁。	X	X	
4070	信息	手动模式	表明已为虚拟站启用手动模式				
4071	信息						
4500	信息	结果 - 驱动故障					
4501	信息	结果 - 重复拧紧	在重复拧紧检测功能开启时试图拧紧已拧紧的螺栓。				
4502	信息	结果 - 软启动扭矩较低	软启动扭矩低于最小水平。				
4503	信息	结果 - 软启动扭矩较高	软启动扭矩超过最大水平。				
4504	信息	结果 - 自攻扭矩较高	自攻扭矩超过最大水平。				
4505	信息	结果 - 自攻扭矩较低	自攻扭矩低于最小限值。				
4506	信息	结果 - 安全扭矩较低	自动计算扭矩值，确保正确安装扭矩传感器。				
4507	信息	结果 - 旋入扭矩较高	旋入扭矩超过最大水平。				
4508	信息	结果 - 旋入角度较高	旋入角度超过最大水平。				
4509	信息	结果 - 旋入时间较高	旋入时间超过最大限值。				

事件代码	类型	名称	说明	程序	L	D	A
4510	信息	结果 - 旋入时间较低	旋入时间低于最小限值。				
4511	信息	结果 - 旋入扭矩较低	旋入扭矩低于最小水平。				
4512	信息	结果 - 旋入角度较低	旋入角度低于最小水平。				
4513	信息	结果 - 最终扭矩较高	最终步骤扭矩超过最大水平。				
4514	信息	结果 - 最终角度较高	最终步骤角度超过最大水平。				
4515	信息	结果 - 最终扭矩较低	最终步骤扭矩低于最小水平。				
4516	信息	结果 - 最终角度较低	最终步骤角度低于最小水平。				
4517	信息	结果 - 拧紧超时	超过拧紧时间限值。				
4518	信息	结果 - 触发器丢失	达到目标前工具触发器已松开。				
4519	信息	结果 - 打滑	套筒从螺母上滑脱。				
4520	信息	结果 - 在最终步骤前达到目标	在拧紧程序的最终步骤前达到目标扭矩。				
4521	信息	结果 - 后视图扭矩较低	后视图扭矩低于最小水平。				
4522	信息	结果 - 后视图扭矩较高	后视图扭矩超过最大水平。				
4523	信息	结果 - 未达到后视图扭矩间隔	未达到后视图扭矩间隔。				
4524	信息	结果 - 未达到扭矩补偿间隔	在未达到旋入端前的扭矩补偿间隔角度。				
4525	信息	结果 - 舒适停机最小值					
4526	信息	结果 - 安全电流监测传感器不匹配	电流监测错误。				
4527	信息	结果 - 舒适停机最大值					
4528	信息	结果 - 软启动角度较高	软启动角度超过最大水平（四步）。				
4529	信息	结果 - 软启动角度较低	软启动角度低于最小水平（四步）。				
4530	信息	结果 - 第一角度较高	初始步骤角度超过最大水平（四步）。				
4531	信息	结果 - 第一角度较低	初始步骤角度低于最小水平（四步）。				
4532	信息	结果 - 第一扭矩较高	初始步骤扭矩超过最大水平（四步）。				
4533	信息	结果 - 第一扭矩较低	初始步骤扭矩低于最小水平（四步）。				
4534	信息	结果 - 第一时间较高	初始步骤时间超过最大水平（四步）。				

事件代码	类型	名称	说明	程序	L	D	A
4535	信息	结果 – 第一时间较低	初始步骤时间低于最小水平（四步）。				
4536	信息	结果 – 最终时间较高	最终步骤时间超过最大水平（四步）。				
4537	信息	结果 – 最终时间较低	最终步骤时间低于最小水平（四步）。				
4538	信息	结果 – 最终监管扭矩较低					
4539	信息	结果 – 软启动时间较高	软启动时间超过最大水平（四步）。				
4540	信息	结果 – 软启动时间较低	软启动时间低于最小水平（四步）。				
4541	信息	结果 – PVT 补偿溢出					
4542	信息	结果 – 贴合监控低					
4543	信息	结果 – 贴合监控高					
4544	信息	结果 – 贴合坡度高					
4545	信息	结果 – 无剩余扭矩					
4546	信息	结果 – 过速					
4547	信息	结果 – 有效拧松					
4548	信息	结果 – 终值低于目标值	最终扭矩低于拧紧程序中设定的目标扭矩。				
4549	信息	超过 TurboTight 时间限制	超过了 TurboTight 时间限值。				
4550	信息	结果 – 旋入脉冲较高					
4551	信息	结果 – 旋入脉冲较低					
4552	信息	结果 – 最终脉冲较高					
4553	信息	结果 – 最终脉冲较低					
5010	警告	无效的拧紧程序参数值	所选拧紧程序中的参数无效。	检查所选拧紧程序的配置，查找并更改参数值。	X	X	
5020	信息	主触发器并非启动来源	当配置为只通过下压式开关启动且用户按压主触发器时生成。直到用户按压下压式开关时生成。	按压下压式开关以启动工具。	X	X	
6010	信息	附件已连接	附件已连接至控制器。			X	X
6020	信息	附件已断开	附件已从控制器断开。			X	X
6021	警告	现场总线脱机	现场总线无通信。		X	X	X
6030	警告	附件地址冲突	两个或更多附件使用相同的地址连接。	更改附件的地址。	X	X	X
6040	警告	附件通信错误	附件出现间歇的通信错误。	校验线缆和连接器。	X	X	
6041	警告	现场总线错误	现场总线出现通信错误。		X	X	X

事件代码	类型	名称	说明	程序	L	D	A
6050	信息	所选套筒错误	没有选择任何套筒或选择了错误的套筒时生成。		X	X	
6090	警告	无法识别条码枪	未找到唯一序列号时。	配置条形码阅读器设备。	X	X	X
7010	信息	要显示的消息文本	显示消息的通用事件。	无			X

NOK 结果列表

错误消息	说明	GUI 位置
驱动错误	??	??
重复拧紧	试图拧紧已拧紧的螺栓。	**拧紧参数（编辑） > 重复拧紧检测**
软启动扭矩低于最小值	软启动扭矩低于最小水平。	**[Four Step] 拧紧参数（编辑） > （第 1 步） 软启动 > 扭矩最小值**
软启动扭矩超过最大值	软启动扭矩超过最大水平。	**拧紧参数（编辑） > （第 1 步） 软启动 > 扭矩最大值**
自攻扭矩超过最大值	自攻扭矩超过最大水平。	**拧紧参数（编辑） > （第 2 步） 自攻 > 扭矩最大值**
自攻扭矩低于最小值	自攻扭矩低于最小限值。	**拧紧参数（编辑） > （第 2 步） 自攻 > 扭矩最小值**
安全扭矩限值低	自动计算扭矩值，确保正确安装扭矩传感器。	**不适用**
旋入扭矩超过最大值	旋入扭矩超过最大水平。	**拧紧参数（编辑） > （第 2 步） 旋入扭矩限值 > 扭矩最大值**
旋入角度超过最大值	旋入角度超过最大水平。	**拧紧参数（编辑） > （第 2 步） 旋入角度限值 > 角度最大值**
旋入超过最大时间限制	旋入时间超过最大限值。	**拧紧参数（编辑） > （第 2 步） 旋入角度限值 > 时间最大值**
旋入低于最小时间限制	旋入时间低于最小限值。	**拧紧参数（编辑） > （第 2 步） 旋入角度限值 > 时间最小值**
旋入扭矩低于最小值	旋入扭矩低于最小水平。	**拧紧参数（编辑） > （第 2 步） 旋入扭矩限值 > 扭矩最小值**
旋入角度低于最小值	旋入角度低于最小水平。	**拧紧参数（编辑） > （第 2 步） 旋入角度限值 > 角度最小值**
最终步骤扭矩超过最大值	最终步骤扭矩超过最大水平。	**拧紧参数（编辑） > （第 3 步） 最终步骤 > 扭矩限值 手动 > 扭矩最大值**
最终步骤角度超过最大值	最终步骤角度超过最大水平。	**拧紧参数（编辑） > （第 3 步） 最终步骤 > 角度最大值**
最终步骤扭矩低于最小值	最终步骤扭矩低于最小水平。	**拧紧参数（编辑） > （第 3 步） 最终步骤 > 扭矩限值 手动 > 扭矩最小值**
最终步骤角度低于最小值	最终步骤角度低于最小水平。	**拧紧参数（编辑） > （第 3 步） 最终步骤 > 角度最大值**
拧紧超时	超过拧紧时间限值。	??
扳机丢失	达到目标前工具触发器已松开。	**不适用**
滑脱	套筒从螺母上滑脱。	**拧紧参数（编辑） > （第 3 步） 拧紧参数 > 滑脱检测时间**
在最终步骤之前达到目标	在拧紧程序的最终步骤前达到目标扭矩。	**目标扭矩**

错误消息	说明	GUI 位置
后视图扭矩低于最小值	后视图扭矩低于最小水平。	**拧紧参数（编辑） > （第 2 步） 后视图扭矩 > 扭矩最小值**
后视图扭矩超过最大值	后视图扭矩超过最大水平。	**拧紧参数（编辑） > （第 2 步） 后视图扭矩 > 扭矩最大值**
未达到柱状图扭矩区间	未达到后视图扭矩间隔。	**拧紧参数（编辑） > （第 2 步） 后视图扭矩 > 扭矩最小长度**
未达到扭矩补偿区间	在未达到旋入端前的扭矩补偿间隔角度。	**拧紧参数（编辑） > （第 3 步） 扭矩补偿值 > 扭矩补偿点**
已超过工具移动限度	移动工具超过设定的角度限值。	**拧紧参数（编辑） > （第 1 步） TrueAngle 补偿（开启）；工具移动限值 > 正/负**
当前监控错误	电流监测错误。	**拧紧参数（编辑） > （第 1 步） 电流监测（开启）**
软启动角度超过最大值	软启动角度超过最大水平。	**[Four Step] 拧紧参数（编辑） > （第 1 步） 软启动 > 角度最大值**
软启动角度低于最小值	软启动角度低于最小水平（四步）。	**[Four Step] 拧紧参数（编辑） > （第 1 步） 软启动 > 角度最小值**
最初步骤角度高	初始步骤角度超过最大水平（四步）。	**[Four Step] 拧紧参数（编辑） > （第 3 步） 初始步骤 > 初始角度最大值**
最初步骤角度低	初始步骤角度低于最小水平（四步）。	**[Four Step] 拧紧参数（编辑） > （第 3 步） 初始步骤 > 初始角度最小值**
最初步骤扭矩高	初始步骤扭矩超过最大水平（四步）。	**[Four Step] 拧紧参数（编辑） > （第 3 步） 初始步骤 > 初始扭矩最大值**
初始步骤扭矩低于最小值	初始步骤扭矩低于最小水平（四步）。	**[Four Step] 拧紧参数（编辑） > （第 3 步） 初始步骤 > 初始扭矩最小值**
初始步骤超过最大时间限制	初始步骤时间超过最大水平（四步）。	**[Four Step] 拧紧参数（编辑） > （第 3 步） 初始步骤 > 时间最大值**
初始步骤低于最小时间限制	初始步骤时间低于最小水平（四步）。	**[Four Step] 拧紧参数（编辑） > （第 3 步） 初始步骤 > 时间最小值**
最终步骤超过最大时间限制	最终步骤时间超过最大水平（四步）。	**[TurboTight, Four Step] 拧紧参数（编辑） > （第 3 步） 最终步骤 > 时间最大值**
最终步骤低于最小时间限制	最终步骤时间低于最小水平（四步）。	**[TurboTight, Four Step] 拧紧参数（编辑） > （第 3 步） 最终步骤 > 时间最小值**
最后一次监控时的扭矩低	??	**??**
软启动超过最大时间限制	软启动时间超过最大水平（四步）。	**[Four Step] 拧紧参数（编辑） > （第 1 步） 软启动 > 时间最大值**
超过 TurboTight 时间限制	??	**??**
贴合监控高	??	**??**
无剩余扭矩	??	**??**
超速	??	**??**

NOK 拧紧的状态

参考

术语与定义

术语	同义词	定义	注意
批次		使用相同拧紧程序和套筒进行多重拧紧	
批次序列	顺序	使用不同的拧紧程序和套筒组合进行多重拧紧	
控制器 GUI		控制器按钮或触摸屏式用户界面	
事件		控制器和工具状态信号	
最终角度		拧紧循环结束时测得的实际角度值	
最终扭矩		拧紧循环结束时测得的实际扭矩值	
GUI		用户接口由交互式图形元素组成，如显示器上的窗口、图标和符号	
HMI	人机界面	工具或控制器的用户界面	HMI 既可以是计算机上基于 Web 的界面，也可以是控制器上的触摸屏。
IAM	智能应用模块	控制器中的可拆卸式模块，包含程序、配置参数和拧紧结果	
线路结构		在 ToolsTalk 中按照结构、文件夹和子文件夹排序并分组控制器	利用线路结构方法，能够以结构化的方式分组大量控制器，提升控制器的直观性。
返回查看扭矩		用于监控并检测旋入完成之前的最大和最小扭矩值的功能	扭矩柱状图的用法之一就是用在自锁紧螺母上。
拧紧程序	参数集	用于控制并监控单次拧紧动作并存储其拧紧结果的参数与值的配置	
推送		将 ToolsTalk 中保存的数据传输到数据库内存	
QIF	高质量集成式拧紧	完全集成系列的螺母扳手、控制器、附件以及流程监控工具，可在工业组装系统中保证拧紧的高质量和可追溯性	QIF 由 Atlas Copco 开发，非常适合用于摩托车行业和其他需要大量连接件的装配情形。QIF 概念还包含过程监控与文档备案。
QIF 附件		QIF 中用作操作员通信和指导的附件	用于在系统与操作员之间通信的附件产品。例如：条形码枪、操作员面板、堆叠灯和套筒选择器。通过通信，可改善装配过程的质量与可追溯性。
快速拧紧步骤		拧紧策略	是一种通过以给定扭矩和速度进行的初始拧紧步骤，然后在最后阶段降低目标转速，来减少连接件预载荷分布的拧紧策略。

术语	同义词	定义	注意
重复拧紧检测		detection of re-tightening of an already tightened joint	
旋转		旋转工具机头的拧紧策略。	旋转主要用于测试或演示目的。
旋入完成		当螺钉头部接触表面时旋入步骤结束，同时拧紧步骤开始	
旋入步骤		螺栓进入螺纹直到螺栓头部接触表面为止的步骤	
贴合		螺钉或螺栓通过手指初步旋紧至表面	
套筒选择器		QIF 附件，包含带灯的套筒架，可用于引导操作员选择正确的套筒	
软启动		通过指定旋转角度以低速开始拧紧	利用此功能，可协助螺栓以受控的方式旋入螺纹，并可避免压下触发器时发生意外的人因工具移动。
排灯		QIF 附件，通过数字信号处理操作员与控制器之间的通讯，例如灯、按钮、开关和蜂鸣器。	
目标		所需的拧紧结果	目标可通过扭矩或角度来表示。
目标角度		拧紧循环完成时所需的角度值（从参考点测量）	
目标扭矩		拧紧循环结束时所需的扭矩值	
三步拧紧		拧紧策略	是一种通过以受限与给定扭矩和速度进行的初始拧紧，然后短暂松开，最后降低速度进行最终拧紧的方式，从而减少连接件预载荷分布和松弛效果的拧紧策略。
拧紧步骤		从螺栓头部接触表面开始，拧紧至所需的目标扭矩或目标角度为止的步骤	
拧紧策略		用于持续控制并监测拧紧过程的算法	用户可选择针对连接件和程序某些参数优化过的策略。
TurboTight		拧紧策略	基于工具执行速度很快且符合人体工学的拧紧操作的最大速度的拧紧策略。此策略仅需设置目标扭矩值。
两步拧紧		拧紧策略	是一种通过以受限与给定扭矩和速度进行的初始拧紧，然后短暂停止，最后降低速度进行最终拧紧的方式，从而减少连接件预载荷分布和松弛效果的拧紧策略。

术语	同义词	定义	注意
Web GUI		用于通过远程计算器的 Web 浏览器访问控制器的用户界面	
虚拟站点	虚拟控制器	物理控制器的软件抽象化表述，可模拟多个控制器	控制器只可连接一个电缆工具，但却可以连接多个无线工具。每个工具与各自虚拟站点相连。

输入信号

代码	输入信号	类型	说明	PF 6000	PF 600
10001	批次递增	事件	批次计数以 1 为单位递增。	X	X
10002	批次递减	事件	批次计数以 1 为单位递减。	X	X
10003	重置批次	事件	批次计数器重置为 0。无批次 OK（nxOK）。如果激活批次 OK，则它会被停用。	X	X
10004	确认事件	事件	确认事件。	X	X
10005	主机解锁	事件	将锁定页面中确定的大部分锁定解锁。	X	X
10006	条形码打码枪输入	事件	例如当 USB 条形码扫码枪扫描到条形码时生成。	X	X
10007	停止驱动	事件	仅限控制器内部使用，被锁具用来停止不断进行的拧紧，参阅“锁定”标签	X	X
10008	忽略拧紧程序	事件	在正在运行的批次序列中跳过下一个拧紧程序。	X	X
10010	拧紧启动（持续）	状态	激活信号开始拧紧。一旦输入信号停止，拧紧也必须停止。	X	X
10011	拧松启动（持续）	状态	激活信号开始拧松。一旦数字输入信号停止，拧松也必须停止。	X	X
10012	终止批次序列	事件	接收到批次序列终止请求时，批次序列功能将等待正在进行的拧紧结果完成，然后再终止批次序列。	X	X
10013	重置过多 NOK	事件	收到锁定“Too Many NOK”（过多 NOK）后，重置批次。	X	X
10014	套筒升高	状态	当唯一的套筒在套筒选择器上升高（整数 = 套筒 ID）、无套筒升高（整数 = 0）或当一个以上的套筒升高（整数 = 0）时生成。	X	X
10015	协议消息准备就绪	事件	当协议消息排队等候时报告。	X	X
10016	选择输入位 0	状态	选定位元 0 的输入信号。	X	X
10017	选择输入位 1	状态	选定位元 1 的输入信号。	X	X
10018	选择输入位 2	状态	选定位元 2 的输入信号。	X	X
10019	选择输入位 3	状态	选定位元 3 的输入信号。	X	X
10020	选择输入	状态	输入选择的值。	X	X
10021	设置双稳态继电器	事件	设置双稳态继电器输出。	X	X
10022	重置双稳态继电器	事件	重置双稳态继电器输出。	X	X
10024	拧紧启动（脉冲）	事件	拧紧在出现信号时开始。直至拧紧结束或直至拧紧程序按出现 30 秒超时结束。	X	X
10028	启动驱动器	状态	激活信号启动工具（默认操作模式为拧紧）。信号一中断，工具就必须停止。用于结合 10029 使用（选择拧松）。	X	X
10029	选择拧松	状态	选择拧松作为默认操作模式，并结合 10028 使用（开始驱动）。	X	X

代码	输入信号	类型	说明	PF 6000	PF 600
10030	拧紧停止（脉冲）	事件	如果产生此信号，将停止任何进行的拧紧操作。与 10024 联用。	X	X
10046	套筒选择器外部绿光	状态	当套筒选择器处于外部模式时，控制绿灯（多台物理设备如何映射到由套筒选择器资源配置定义的逻辑套筒）字节 0 — 逻辑套筒 1-4，字节 1 — 逻辑套筒 5-8，字节 2 — 逻辑套筒 9-12，字节 3 — 逻辑套筒 13-16（每个套筒 2 位，00=关闭，01=闪灯，10=稳定）	X	
10047	套筒选择器外部红光	状态	当套筒选择器处于外部模式时，控制绿灯。参见 10046，了解详情。	X	
10048	软选择输入值	状态	输入软选择值	X	X
10049	停用现场总线	状态	停用现场总线。	X	
10050	用户 ID	状态	用户 ID	X	
10051	结束时解锁工具	事件	结束时解锁由工具锁定来锁定的工具。	X	X
10052	HMI 选择值	状态	从 HMI 选择拧紧程序。	X	X
10053	重置批次序列	事件	重置批次序列。结束时解锁由工具锁定来锁定的工具。	X	X
10058	工具绿色 LED 闪烁	事件		X	
10059	停用时解锁工具	事件		X	
10060	禁用开放协议命令	状态		X	
30004	读取结果握手	状态		X	

锁定使用的输入信号

代码	输入信号	类型	说明	PF 6000	PF 600
20002	数字输入锁定拧紧	状态	工具被数字输入锁住进行拧紧。	X	
20003	数字输入锁定拧松	状态	批次计数以 1 为单位递减。	X	
20004	数字输入锁定工具	状态	批次计数器重置为 0。	X	
20020	现场总线锁定拧紧	状态	确认事件。	X	
20021	现场总线锁定拧松	状态	将锁定页面中确定的大部分锁定解锁。	X	

输出信号

代码	输出信号	类型	说明	PF 6000	PF 600
3	拧紧正常	事件	“拧紧 OK”说明拧紧结果在规定限制范围内。	X	X
4	拧紧异常	事件	“拧紧 NOK”说明至少一个拧紧结果超出规定限制范围，或者另一个不可接受事件发生。	X	X
5	最终扭矩	事件		X	X
6	扭矩过小	事件	扭矩结果低于最小扭矩限值。	X	X
7	扭矩过大	事件	扭矩结果高于最大扭矩限值。	X	X
8	最终角度	事件		X	X
9	角度过小	事件	角度结果低于最小角度限值。	X	X
10	角度过大	事件	角度结果高于最大角度限值。	X	X

代码	输出信号	类型	说明	PF 6000	PF 600
11	按下触发器	状态	表示工具触发器已经按下。	X	X
12	方向开关顺时针	状态	工具上的方向开关以顺时针转动。	X	X
13	方向开关逆时针	状态	工具上的方向开关以逆时针转动。	X	X
21	工具拧紧中	状态	工具沿拧紧方向运转。	X	X
22	工具反松中	状态	工具沿拧松方向运转。	X	X
23	工具运行中	状态	表示工具正在转动（顺时针 [CW] 或逆时针 [CCW]）。	X	X
24	工具旋转顺时针	状态	右旋螺纹的工具转动方向为顺时针。	X	X
25	工具旋转逆时针	状态	左旋螺纹的工具转动方向为逆时针。	X	X
26	螺纹方向逆时针	状态	为选定 p-set 选择的螺纹方向为逆时针。	X	X
27	拧紧已被锁定	状态	拧紧被禁用。	X	X
28	反松已被锁定	状态	拧松被禁用。	X	X
29	准备好启动	状态	表示是否可以开始拧紧。	X	X
30	批次已完成	事件	批次计数器等于批次容量数字。结果可能是 OK 或 NOK。	X	X
31	批次计数	状态	批次中的当前数字。仅可以在显示器中查看。	X	X
32	批次进行中	状态	表示批次序列中的一个批次正在运行。	X	X
33	剩余批次	状态	批次中的剩余拧紧数。仅可以在显示器中查看。	X	X
34	测试	状态	反映测试信号输入。	X	X
35	达到最多连续 NOK	事件		X	X
36	批次结束 OK	事件	批次完成，状态 OK。	X	X
37	批次结束 NOK	事件	批次完成，状态 NOK。	X	X
38	套筒提示信息	事件	造成套筒选择器上的绿色 LED 闪烁或熄灭。整数是一个掩码，其中的每一位都表示一个套筒 LED。例如0 位 = 套筒 1，X 位 = 套筒 x+1。最多可以控制 32 个 LED。	X	
39	清除结果	事件		X	X
40	双稳态继电器	状态	根据 2 种输入信号：设置/重置双稳态继电器。	X	X
42	IO 开启	状态	IOExchange 启动时设为真。	X	X
45	批次序列正常完成	事件	批次序列完成，状态 OK。	X	X
46	批次序列结束 NOK	事件	批次序列完成，状态 NOK。	X	X
47	批次序列运行中	状态	选定了一个批次序列并且正在运行。	X	X
48	批次序列完成	事件	批次序列计数器等于批次序列容量。结果可能是 OK 或 NOK。	X	X
69	所选的拧紧程序 ID	状态	已选拧紧程序的实际 ID，如果未选择拧紧程序，则为 0。	X	
70	反松正常	事件	正常拧松发生。	X	X
71	站准备好	状态	站已准备好。	X	X
73	工具已连接	状态	如果工具已连接并配置到虚拟站点，那么此 IO 已激活。	X	X
74	拧松 NOK	事件	拧松 NOK 发生。	X	X
84	所选批次序列 ID	状态		X	
89	开口端处于打开位置	状态	开口端工具处于打开位置。	X	
90	工具电池电量低	事件	工具电池电量低。	X	
92	工具在使用中	状态		X	X
93	工具处于生产区	状态		X	X
94	工具标签标识符	状态		X	
95	开放协议已断开	状态		X	
96	现场总线已断开	状态		X	

代码	输出信号	类型	说明	PF 6000	PF 600
97	红色工具 LED 指示灯	事件		X	
98	绿色工具 LED 指示灯	事件		X	
99	黄色工具 LED 指示灯	事件		X	
30000	禁用工具	状态		X	X
30001	事件代码	状态		X	X
30003	事件代码	状态		X	X
30100	目标扭矩	事件		X	x
30101	目标/最终扭矩	事件		X	X
31000	拧紧正常	状态		X	X
31001	拧紧异常	状态		X	X
31002	最终扭矩	状态		X	X
31003	最终角度	状态		X	X
31004	拧紧程序最大角度	状态		X	X
31005	拧紧程序最小角度	状态		X	X
31006	最终角度状态	状态		X	X
31007	拧紧程序最大扭矩	状态		X	X
31008	拧紧程序最小扭矩	状态		X	X
31009	最终扭矩状态	状态		X	X
31010	完成拧紧	状态		X	

输入/输出信号

这些信号用于输入和输出。

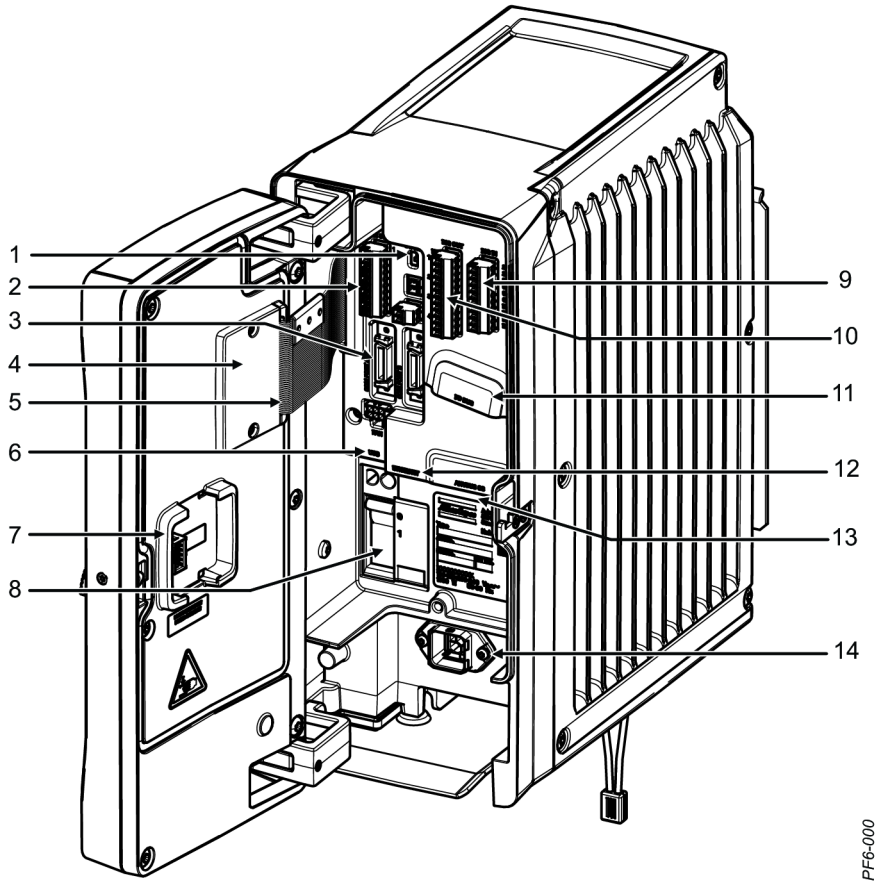
代码	信号	类型	说明
50	一般 I/O 1	状态	输入/输出 1。
51	一般 I/O 2	状态	输入/输出 2。
52	一般 I/O 3	状态	输入/输出 3。
53	一般 I/O 4	状态	输入/输出 4。
54	一般 I/O 5	状态	输入/输出 5。
55	一般 I/O 6	状态	输入/输出 6。
56	一般 I/O 7	状态	输入/输出 7。
57	一般 I/O 8	状态	输入/输出 8。
58	一般 I/O 9	状态	输入/输出 9。
59	一般 I/O 10	状态	输入/输出 10。
10035	外部监控 1	状态	数字输入 1 - 8，通过开放协议监测，MID 210
10036	外部监控 2	状态	
10037	外部监控 3	状态	
10038	外部监控 4	状态	
10039	外部监控 5	状态	
10040	外部监控 6	状态	
10041	外部监控 7	状态	
10042	外部监控 8	状态	

代码	信号	类型	说明
10043	套筒升高原料	状态	添加用于针对套筒升高通知在部分协议中支持与 PF4000 的向后兼容性（与套筒升高 10013 相对）。整数表示针对所有升高的套筒位组合（无论是否闪光或升高多少）。
10045	外部标识符	状态	由外部系统发送的标识符
30002	现场总线保持	状态	

附录 A - 控制器连接

前部连接

Power Focus 6000 控制器前盖后的连接和开关：



前盖后的控制器连接

1. 远程启动
2. 紧急停止
3. COM 端口
4. 电池
5. 电缆
6. USB 端口
7. IAM
8. 电流式漏电断路器 (RCBO)
9. 数字输入
10. 数字输出
11. I/O 总线
12. 工厂以太网端口
13. Anybus CC
14. 电源连接器

附录 B - 远程启动和紧急停机

远程启动配置

当处于单控制器配置和多控制器配置时，均可通过附件远程启动拧紧。远程启动启用开关位于控制器前检修门后部的连接器面板上。参见“控制器连接”。

出于安全考虑，无论何时使用远程启动，都必须实施紧急停机解决方案。有关紧急停机的更多信息，请参阅 Power Focus 6000 产品说明中的紧急停机（EM Stop）。

当使用带某些类型的安全操控装置（例如触发器启动按钮或安全操纵杆）的工具时，必须通过将开关设置为“OFF”禁用远程启动。如此操作是为了确保不会超越工具内的安全功能。另请参阅“不带紧急停机按钮的单控制器”。

Power Focus 6000 的紧急停机

根据 **EN ISO 13849-1 分类 3 PL d**的要求，Power Focus 6000 提供基础架构，可通过冗余阻断建立紧急停机功能。在使用远程启动功能时，必须使用紧急停机功能。

紧急停机功能可与电源切断装置（例如紧急停机按钮）一起使用。按下紧急停机按钮时，将切断控制器的电源电压。

控制器启动时自动运行系统诊断。它会在紧急停机和正常启动后完成。

紧急停机功能与单个紧急停机链中的单个控制器或多达 10 个控制器一起使用。在多控制器配置中，紧急停机信号会通过 I/O 总线接口从第一个控制器传输到所有互连的控制器。链条中的最后一个控制器会返回反馈信号，以指示所有控制器都收到了紧急停机信号。显示事件 **Emergency stop**（紧急停机）。

对于紧急停机，连接器面板上配有一个经过紧急停机接口的 24V 直流输出端。

布线

紧急停机按钮线缆

单个/多个控制器	尺寸	最大长度
单个	0.7 mm^2 线缆	400 米
多个	1.5 mm^2 线缆	50 米

紧急停机按钮的线缆尺寸

I/O 线缆

为了用 I/O 线缆连接多个控制器并传输紧急停机信号，请按下表观察最大长度：

AWG 22 线缆	最大总长度
4 个控制器	200 米
5 个控制器	140 米
6 个控制器	100 米
8 个控制器	70 米
10 个控制器	50 米

用于 I/O 线缆的线缆尺寸

紧急停机的针脚配置

Power Focus 配有一个外部紧急停机接口和 I/O 总线，它们位于*前检修 [页次 132]*后部的连接器面板上。

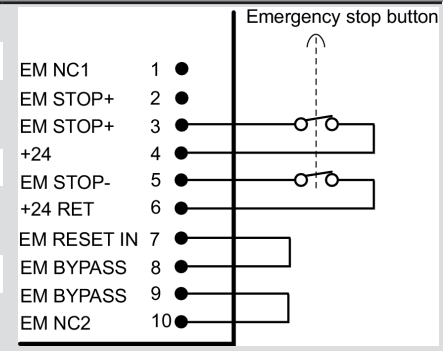
管脚配置视单控制器还是多控制器解决方案而有所差异。此外，对于单控制器，针脚配置还因控制器是否装备紧急停机按钮而不同。

下列部分描述连接面板上可用的针脚，以及不同的针脚连接至紧急停机按钮的用法。

带紧急停机按钮的单控制器

连接器：Phoenix，6 脚排针，3.5mm 间距

使用下列针脚附加紧急停机按钮： 针脚	使用
1	不要使用
2	不要使用
3	在针脚 3 和针脚 4 之间附加紧急停机按钮
4	参见针脚 3
5	在针脚 5 和针脚 6 之间附加紧急停机按钮
6	参见针脚 5
7	在针脚 7 和针脚 8 之间连接跨接线
8	参见针脚 7
9	在针脚 9 和针脚 10 之间连接跨接线
10	参见针脚 9



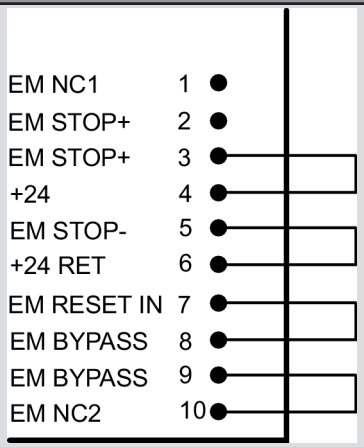
单控制器接头

不带紧急停机按钮的单控制器

⚠ **警告 对于此配置，必须将远程启动开关设置为“OFF”（关闭）**

连接器：Phoenix，6 脚排针，3.5mm 间距

使用以下针脚配置： 针脚	使用
1	不要使用
2	不要使用
3	在针脚 3 和针脚 4 之间连接跨接线
4	参见针脚 3
5	在针脚 5 和针脚 6 之间连接跨接线
6	参见针脚 5
7	在针脚 7 和针脚 8 之间连接跨接线
8	参见针脚 7
9	在针脚 9 和针脚 10 之间连接跨接线
10	参见针脚 9



非 EM 停机的接头

带紧急停机按钮的多控制器

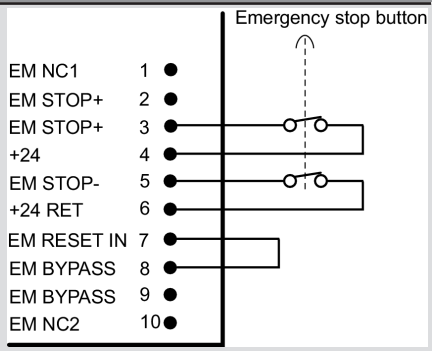
PIN 配置视紧急停机链中的控制器位置而有所不同。

带紧急停机按钮的第一个控制器已连接

紧急停机按钮连接器：Phoenix，6 脚排针，3.5mm 间距

紧急停机 I/O 线缆连接器：Molex Micro-Fit，5 针脚

使用以下针脚配置： 引脚	使用
1	不要使用
2	不要使用
3	在针脚 3 和针脚 4 之间附加紧急停机按钮
4	参见针脚 3
5	在针脚 5 和针脚 6 之间附加紧急停机按钮
6	参见针脚 5
7	在针脚 7 和针脚 8 之间连接跨接线
8	参见针脚 7
9	不要使用
10	不要使用



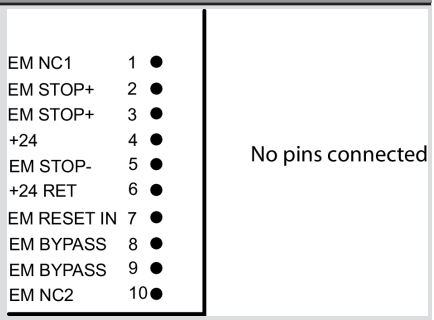
第一个控制器的接头

介于第一个与最后一个之间的控制器

紧急停机 I/O 线缆连接器：Molex Micro-Fit，5 针脚

拔下插头，或使用以下针脚配置：

引脚	使用
1	不要使用
2	不要使用
3	不要使用
4	不要使用
5	不要使用
6	不要使用
7	不要使用
8	不要使用
9	不要使用
10	不要使用

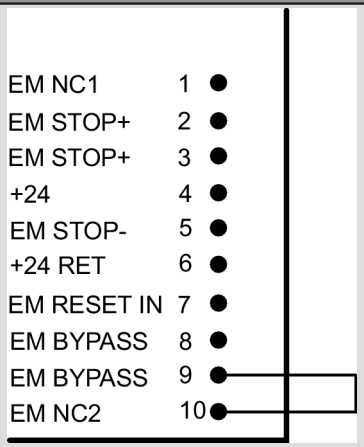


中间控制器的接头

最后一个控制器

紧急停机 I/O 线缆连接器：Molex Micro-Fit，5 针脚

使用以下针脚配置： 引脚	使用
1	不要使用
2	不要使用
3	不要使用
4	不要使用
5	不要使用
6	不要使用
7	不要使用
8	不要使用
9	在针脚 9 和针脚 10 之间连接跨接线
10	参见针脚 9



最后控制器的接头

附录 C - 数字信号输入/输出连接器

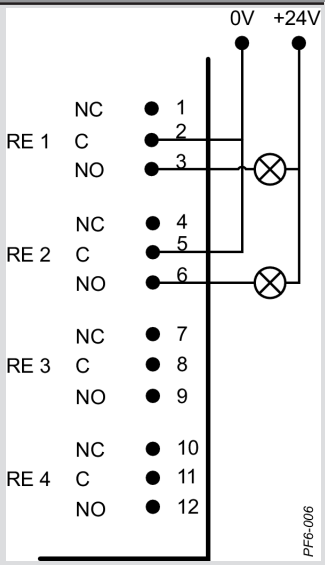
Power Focus 6000 与 Power Focus 4000 系统使用相同的硬件附件（排灯、操作面板等）。不过，数字输入和输出连接器的配置方式不同，并且使用不同的插头。为了将插头从 Power Focus 4000 正确地重新连接到 Power Focus 6000，请使用以下章节中的连接器描述。

数字输出连接器

Power Focus 6000 配有一个连接器及四个可配置的内部数字信号输出单元 (DIG OUT)，它们位于*前检修[页次 132]*门后部。

Power Focus 6000 的数字输出连接器

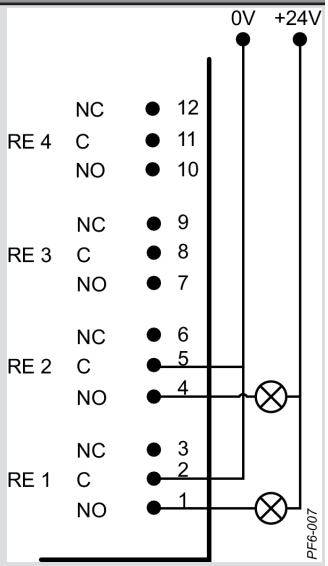
引脚	继电器	功能
1		常闭
2	继电器 1	常见
3		常开
4		常闭
5	继电器 2	常见
6		常开
7		常闭
8	继电器 3	常见
9		常开
10		常闭
11	继电器 4	常见
12		常开



输入连接器

Power Focus 4000 的数字输出连接器

引脚	继电器	功能
12		常闭
11	继电器 4	常见
10		常开
9		常闭
8	继电器 3	常见
7		常开
6		常闭
5	继电器 2	常见
4		常开
3		常闭
2	继电器 1	常见
1		常开



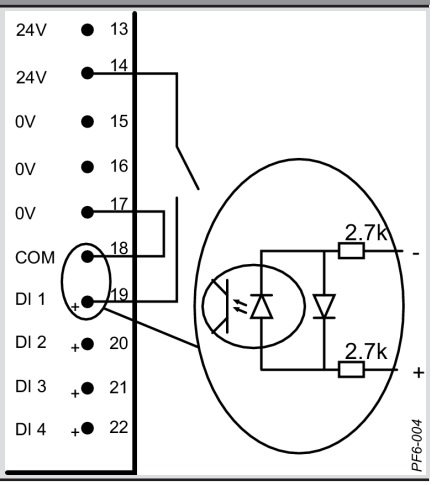
输入连接器

数字输入连接器

Power Focus 6000 配有一个连接器及四个可配置的内部数字输入单元 (DIG IN)，它们位于*前检修 [页次 132]*门后部。

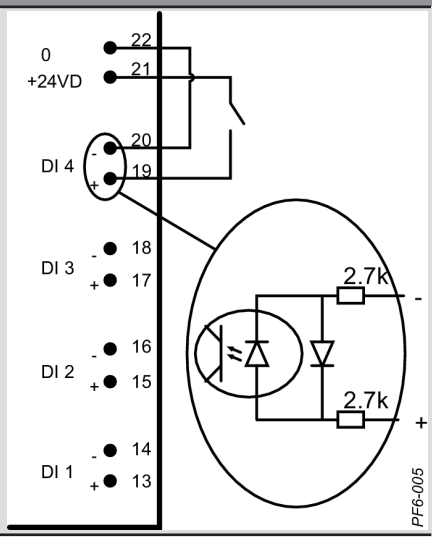
Power Focus 6000 的数字输入连接器

引脚	功能
13	24V
14	24V
15	0V
16	0V
17	0V
18	数字输入 -
19	数字输入 1 +
20	数字输入 2 +
21	数字输入 3 +
22	数字输入 4 +



Power Focus 4000 的数字输入连接器

引脚	功能
22	GND（+24 伏直流电隔离）
21	+24 伏直流电隔离
20	数字输入 4 -
19	数字输入 4 +
18	数字输入 3 -
17	数字输入 3 +
16	数字输入 2 -
15	数字输入 2 +
14	数字输入 1 -
13	数字输入 1 +



第三方许可

List of Third Party Softwares

The following third party softwares are included in the software for the Power Focus controller. The license texts are available in alphabetic order following this table.

Software	Version	License
alsa-conf-base	1.0.27.2	LGPL V2.1
alsa-lib	1.0.27.2	LGPL V2.1
alsa-states	0.2.0	MIT
alsa-tools	1.0.27	GNU GPL V2
alsa-utils	1.0.27.2	GNU GPL V2
alsa-utils-aconnect	1.0.27.2	GNU GPL V2
alsa-utils-alsactl	1.0.27.2	GNU GPL V2
alsa-utils-alsaloop	1.0.27.2	GNU GPL V2
alsa-utils-alsamixer	1.0.27.2	GNU GPL V2
alsa-utils-alsaucm	1.0.27.2	GNU GPL V2
alsa-utils-amixer	1.0.27.2	GNU GPL V2
alsa-utils-aplay	1.0.27.2	GNU GPL V2
alsa-utils-aseqdump	1.0.27.2	GNU GPL V2
alsa-utils-aseqnet	1.0.27.2	GNU GPL V2
alsa-utils-iecset	1.0.27.2	GNU GPL V2
alsa-utils-midi	1.0.27.2	GNU GPL V2
alsa-utils-speakertest	1.0.27.2	GNU GPL V2
atftpd	0.7.1+	GNU GPL V2
base-files	3.0.14	GNU GPL V2
base-passwd	3.5.29	GNU GPL V2
bash	4,3	GNU GPL V3
bash-completion	2,1	GNU GPL V2
bluetooth-test	1	GNU GPL V1.0
boost	1.55.0	MIT
boost-serialization	1.55.0	MIT
boost-test	1.55.0	MIT
bt-aux	1	GNU GPL V1.0
busybox	1.22.1	GNU GPL V2
busybox-cron	1.22.1	GNU GPL V2
busybox-hwclock	1.22.1	GNU GPL V2
busybox-udhcpc	1.22.1	GNU GPL V2
busybox-udhcpd	1.22.1	GNU GPL V2
ca-certificates	20130610	GNU GPL V2
cppunit	1.13.1	LGPL V2.1
curl	7.36.0	MIT
dbus-1	1.6.18	GNU GPL V2
dbus-c++	0.9.0	LGPL V2.1
directfb-config	1	GNU GPL V1.0
dropbear	2014,63	BSD V3
e2fsprogs	1.42.9	GNU GPL V2
e2fsprogs-badblocks	1.42.9	GNU GPL V2

Software	Version	License
e2fsprogs-e2fsck	1.42.9	GNU GPL V2
e2fsprogs-mke2fs	1.42.9	GNU GPL V2
e2fsprogs-tune2fs	1.42.9	GNU GPL V2
eclr	2.2.0.20725	MIT
ecryptfs-tools	1	GNU GPL V1.0
fbset	2,1	GNU GPL V2
fbset-modes	0.1.0	MIT
fb-test	1.1.0	GNU GPL V2
fieldbus-test	1	GNU GPL V1.0
firmware-imx	3.10.17-1.0.0	Proprietary
firmware-imx-sdma-imx51	3.10.17-1.0.0	Proprietary
gdbserver	7,7	GNU GPL V2
gnutls	3.2.13	LGPL V2.1
gpio	1	GNU GPL V1.0
groupexec	0.0.1	GNU GPL V1.0
gstreamer	0.10.36	LGPL V2.1
gstreamer1.0	1.2.4	LGPL V2.1
gwt	2.6.1	Apache V2
gwt-ns	0.2.1	Apache V2
json-c	0,11	MIT
kernel-3.14.15.atlas	3,14	GNU GPL V2
kernel-base-generic	0.1+hg-8d6f9d23fb4a-r8-px2pfm4.12	GNU GPL V2
kernel-base-px2drv	2.6.22.6-r8-px2pfm4.12	GNU GPL V2
kernel-dev-generic	2.6.22.6-r8-px2pfm4.12	GNU GPL V2
kernel-devicetree	3,14	GNU GPL V2
kernel-dev-px2drv	2.6.22.6-r8-px2pfm4.12	GNU GPL V2
kernel-generic	2.6.22.6-r8-px2pfm4.12	GNU GPL V2
kernel-image-3.14.15-atlas	3,14	GNU GPL V2
kernel-image-generic	2.6.22.6-r8-px2pfm4.12	GNU GPL V2
kernel-image-px2drv	2.6.22.6-r8-px2pfm4.12	GNU GPL V2
kernel-module-emergencystop	0.0.1	MIT
kernel-module-ioaccess	1	GNU GPL V2
kernel-module-owl2xx	3.1.6	MIT
kernel-module-owl2xx-spi	3.1.6	MIT
kernel-px2drv	2.6.22.6-r8-px2pfm4.12	GNU GPL V2
kernel-vmlinux-generic	2.6.22.6-r8-px2pfm4.12	GNU GPL V2
kernel-vmlinux-px2drv	2.6.22.6-r8-px2pfm4.12	GNU GPL V2
keytest	1	GNU GPL V1.0
keyutils	1.5.2	GNU GPL V2
kmsfbwrap	10	GNU GPL V2
libanybus1	1	LICENSE
libasound2	1.0.27.2	LGPL V2.1
libblkid1	2.24.2	GNU GPL V2
libboost-date-time1.55.0	1.55.0	MIT
libboost-filesystem1.55.0	1.55.0	MIT
libboost-graph1.55.0	1.55.0	MIT
libboost-iostreams1.55.0	1.55.0	MIT

Software	Version	License
libboost-program-options1.55.0	1.55.0	MIT
libboost-regex1.55.0	1.55.0	MIT
libboost-signals1.55.0	1.55.0	MIT
libboost-system1.55.0	1.55.0	MIT
libboost-thread1.55.0	1.55.0	MIT
libbz2-0	1.0.6	bzip2
libc6	2,19	GNU GPL V2
libcap2	2,22	BSD V2
libcom-err2	1.42.9	GNU GPL V2
libcurl5	7.36.0	MIT
libdbus-1-3	1.6.18	GNU GPL V2
libdrm2	2.4.53	MIT
libe2p2	1.42.9	GNU GPL V2
libegl1	11.09.01	Proprietary
libestr0	0.1.6	LGPL V2.1
libevent	2.0.21	BSD V2
libexpat1	2.1.0	MIT
libext2fs2	1.42.9	GNU GPL V2
libffi6	3.0.13	MIT
libformw5	5,9	MIT
libfuse2	2.9.3	GNU GPL V2
libgcc1	4.8.2	GNU GPL V3
libgcrypt	1.6.1	LGPL V2.1
libglesv2-2	11.09.01	Proprietary
libglib-2.0-0	2.40.0	LGPL V2.1
libgmp10	5.1.1	GNU GPL V3
libgpg-error0	1,12	LGPL V2.1
libgsl-fsl1	11.09.01	Proprietary
libgstapp-1.0-0	1.2.4	GNU GPL V2
libgstaudio-1.0-0	1.2.4	GNU GPL V2
libgstpbutils-1.0-0	1.2.4	GNU GPL V2
libgsttag-1.0-0	1.2.4	GNU GPL V2
libgstvideo-1.0-0	1.2.4	GNU GPL V2
libicudata53	53,1	ICU
libicui18n53	53,1	ICU
libicuuc53	53,1	ICU
libjpeg8	8d	BSD V3
libkmod2	17+	LGPL V2.1
liblzo2-2	2,06	LGPL V2.1
libmenuw5	5,9	MIT
libmount1	2.24.2	GNU GPL V2
libncursesw5	5,9	MIT
libnet1	1.1.6	BSD V2
libnfsidmap0	0,25	BSD V2
libopkg1	0.2.2	GNU GPL V2
liborc-0.4-0	0.4.18	BSD V2
libpanelw5	5,9	MIT
libpcap1	1.5.3	BSD V2

Software	Version	License
libperl5	5.14.3	GNU GPL V1.0
libpng16-16	1.6.10	Libpng
libpopt0	1,16	MIT
libpx2dbus	1	GNU GPL V1.0
libqt5sensors5	5.3.1	LGPL V2.1
librcf	2	Proprietary
libreadline6	6,3	GNU GPL V3
libsamplerate0	0.1.8	GNU GPL V2
libsndfile1	1.0.25	LGPL V2.1
libsqlite3-0	3.8.4.3	PD
libss2	1.42.9	GNU GPL V2
libstdc++6	4.8.2	GNU GPL V3
libthread-db1	2,19	GNU GPL V2
libtinfo5	5,9	MIT
libtinyxml2.6.2	2.6.2	Zlib
libtirpc1	0.2.4	BSD V2
libts-1.0-0	1,1	LGPL V2.1
libudev0	182	LGPL V2.1
liburcu	0.8.1	LGPL V2.1
libusb-1.0-0	1.0.9	LGPL V2.1
libuuid1	2.24.2	GNU GPL V2
libwrap0	7,6	BSD V2
libxml2	2.9.1	MIT
libxlst	1.1.28	MIT
libz1	1.2.8	Zlib
logrotate	3.8.7	GNU GPL V2
log-server	1	GNU GPL V1.2
loopback	1	GNU GPL V1.2
lttng-tools	v2.4.0	GNU GPL V2
lttng-ust	2.4.0	LGPL V2.1
lua5.1	5.1.5	MIT
luabind	0.9.1	MIT
lzop	1,03	GNU GPL V2
modutils-initscripts	1	PD
mtd-utils	1.5.1 + gitAUTOINC+9f107132a6	GNU GPL V2
nano	2.2.5	GNU GPL V2
ncurses	5,9	MIT
ncurses-terminfo	5,9	MIT
ncurses-terminfo-base	5,9	MIT
netbase	5,2	GNU GPL V2
nettle	2.7.1	LGPL V2.1
nfs-utils	1.2.9	GNU GPL V2
nfs-utils-client	1.2.9	GNU GPL V2
ntp	4.2.6p5	Ntp License
ntp-tickadj	4.2.6p5	Ntp License
ntp-utils	4.2.6p5	Ntp License
openssh-sftp	6.5p1	BSD V2
openssh-sftp-server	6.5p1	BSD V2

Software	Version	License
opkg	0.2.2	GNU GPL V2
opkg-collateral	1	MIT
opkg-config-base	1	MIT
packagegroup-atlas-qt5	1	MIT
packagegroup-core-boot	1	MIT
packagegroup-core-eclipse-debug	1	MIT
packagegroup-core-nfs-server	1	MIT
packagegroup-core-ssh-dropbear	1	MIT
packagegroup-px2it	1	MIT
perl	5.14.3	GNU GPL V1.0
pfmfonts	0.0.1	Apache V2
pfmtool	1	MIT
pfmtool-bash-completion	1	MIT
pfmversion	5.4.2	MIT
pointercal	0	MIT
poky-feed-config-opkg	1	MIT
qt3d	5.3.0+	LGPL V2.1
qtbase	5.3.1	LGPL V2.1
qtbase-plugins	5.3.1	LGPL V2.1
qtbase-tools	5.3.1	LGPL V2.1
qtdeclarative	5.3.1	LGPL V2.1
qtlocation	5.3.1	LGPL V2.1
qtscript	5.3.1	LGPL V2.1
qtwebkit	5.3.1	LGPL V2.1
rhapsody-oxf	7521	GNU GPL V1.0
rpcbind	0.2.1	BSD V2
rsync	3.1.0	GNU GPL V3
rsyslog	7.4.4	GNU GPL V3
rtctest	1	GNU GPL V1.0
run-postinsts	1	MIT
shadow	4.1.4.3	BSD V2
shadow-securetty	4.1.4.3	MIT
sqlite3	3.8.4.3	PD
ssh-keys	1	GNU GPL V1.0
strace	4,8	BSD V2
sysvinit	2.88dsf	GNU GPL V2
sysvinit-inittab	2.88dsf	GNU GPL V2
sysvinit-pidof	2.88dsf	GNU GPL V2
tcf-agent	0.4.0+	EPL V1.0
tcpdump	4.3.0	BSD V2
tslib-calibrate	1,1	LGPL V2.1
tslib-conf	1,1	LGPL V2.1
tslib-tests	1,1	LGPL V2.1
tzdata	2013i	BSD V2
tzdata-africa	2013i	BSD V2
tzdata-americas	2013i	BSD V2
tzdata-antarctica	2013i	BSD V2
tzdata-arctic	2013i	BSD V2

Software	Version	License
tzdata-asia	2013i	BSD V2
tzdata-atlantic	2013i	BSD V2
tzdata-australia	2013i	BSD V2
tzdata-europe	2013i	BSD V2
tzdata-misc	2013i	BSD V2
tzdata-pacific	2013i	BSD V2
tzdata-posix	2013i	BSD V2
tzdata-right	2013i	BSD V2
u-boot-image	2014,04	GNU GPL V2
u-boot-utils	2014,04	GNU GPL V2
udev	182	GNU GPL V2
udev-cache	182	GNU GPL V2
udev-utils	182	GNU GPL V2
update-alternatives-opkg	0.1.8+gitAUTOINC+c33b217016	GNU GPL V2
update-rc.d	0,7	GNU GPL V2
usbutils	7	GNU GPL V2
usbutils-ids	7	GNU GPL V2
wireless-tools	30.pre9	GNU GPL V2
wpa-supplicant	2,3	BSD V2
wpa-supplicant-cli	2,3	BSD V2
wpa-supplicant-passphrase	2,3	BSD V2
xerces-c	2.7.0aes	Apache V2
zipfirmware-install-px2drv-tplcpx-4.	3	BSD V3
u-boot-utils	2010.03-r56-px2pfm4.12	GNU GPL V2

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48. [52]Ray Schnitzler <schnitz@unipress.com> Unixware1 port
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51. [55]Harlan Stenn <harlan@pfcs.com> GNU automake/autoconfigure makeover, various other bits (see the ChangeLog)
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