

INTEGRATION MANUAL 集成手册



Integrated Motor Drive 集成式电机驱动器 IMD 100



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1. Introduction 概要

This document describes the IMD 100 in details to enable the integration of the IMD in a pitch system. It is intended for customers R&D personnel, who will integrate the IMD in the pitch system. All aspects of the integration are included in this manual:

本文档详细介绍了 IMD 100，实现 IMD 集成到变桨系统中。本文档专为将 IMD 集成到变桨系统中的客户研发人员设计。本手册包含了集成的所有方面：

- Mechanical integration:机械集成：
 - Mechanical specifications and requirements 机械规格和要求
 - Description of mechanical installation options 机械安装选项说明
 - Space requirements 空间要求
- Electrical requirements:电气要求
 - Description of electrical connections 电气连接说明
 - Requirements for all electrical interfaces 所有电气接口要求
- Configuration 配置
 - Configuration of the IMD for a specific system using the IMD Manager 使用 IMD manager 软件为特定系统配置 IMD 参数
 - Creation of a configuration file for use in production 创建用于生产的配置文件
- Operation – control and monitoring 运行—控制和监控
 - Communication 通信
 - Operational states 运行状态
 - Input and output states 输入和输出状态
 - Monitoring parameters 监控参数
 - Warnings 警告
 - Errors 故障
 - Interpretation of numeric representation – units' conversion 数字表示的解释—单位转换
- Starting the IMD in the laboratory for the first time 首次在实验室启动 IMD



Read instructions 阅读说明

Read the *IMD 100 function description*(document no. 4189360013) in order to understand the functions of the IMD. Description of the functions is not repeated in this manual.

References are made in this manual to *IMD 100 Installation instructions*, *IMD Manager Installation instructions*, *IMD Manager user manual* and *IMD 100 Datasheet*. Have these at hand while reading this manual.

阅读 IMD 100 功能概要（文档编号：4189360013）以了解 IMD 的功能。本手册不再重复功能说明。

本手册中参考了《IMD 100 安装说明》、《IMD 监控软件安装说明》、《IMD Manager 软件用户手册》和《IMD 100 数据表》。阅读本手册时，请随身携带这些手册。

1.1 Conventions 标注

The following conventions are used in this document:在本文档中遵循以下惯例:

Used in document 在文档中使用	Description 描述
Monotype font 铅字字体	Used when describing a path or text input in a machine human interface 用于在人机界面中描述路径或文本输入
	Used to illustrate a space and Enter characters 用于显示空格和回车字符
	A yellow symbol that illustrates hazard type (this symbol is an example for general hazard). There are different types such as electrical, chemical and so on.表示危险类型的黄色符号(此符号是一般危险的示例)。有不同的类型，如电气、化学等
Danger!危险!	A signal word used to indicate an imminently hazardous situation, which if not avoided, will result in death or serious injury. (ISO 3864)用于指示紧急危险情况的信号词，如果不避免，将导致死亡或重伤(ISO 3864)
Warning!警告!	A signal word used to indicate an imminently hazardous situation, which if not avoided, could result in death or serious injury. (ISO 3864)用于指示紧急危险情况的信号词，如果不避免，将导致死亡或重伤(ISO 3864)
Caution!注意!	A signal word used to indicate a potentially hazardous situation, which if not avoided, could result in minor or moderate injury. (ISO 3864)用于表示潜在危险情况的信号词，如果不避免，可能会导致轻微或中等的人身伤害。(ISO 3864)
	A blue symbol that illustrates a need for mandatory action. In this example read instructions. Other types of blue symbols exist and always indicate mandatory action.表示需要采取强制性措施的蓝色符号。在本例中，请阅读说明。存在其他类型的蓝色符号，并且始终表示强制性措施。
	A symbol used to draw attention to extra information or an action that is not mandatory 用于提示注意额外信息或非强制性措施的符号
Current 电流	When “current” is used it always means electrical current. When a reference to time is made “present” or “ongoing” are used.当使用 “current” 时一般是指电流。当提及时间时，则表示 “当前” 或 “正在进行”。
IMD	When the IMD is mentioned, it means the IMD 100 series 这里提到的 IMD 是指 IMD 100 产品系列
Binary description 二进制描述	In binary descriptions the first bit is bit zero 在二进制描述中，第一位是 Bit 0

2. Safety precautions 安全注意事项



Attention 注意

The permitted environmental conditions must be observed. 必须遵守经许可的环境条件。

EN 60204, and relevant local regulations must be observed. 必须遵守 EN 60204 和当地相关法规。

Power supply of protection class I and of protection degree IP20. Do not use outside or in wet or damp rooms. 请勿在室外或潮湿的房间内使用防护等级 I 和防护等级 IP20 的电源。

The equipment must be installed, operated and used for its intended function as described by the manufacturer. If this requirement is ignored, safety protection provided by the equipment may be impaired. 必须按照制造商的说明安装、操作和使用设备以实现其预期功能。如果忽略此要求，设备提供的安全保护可能会受到影响。

In the event of a fault we recommend that you return the unit to the manufacturer. 如果出现故障，我们建议您将设备退回制造商。

Company policy and local regulations regarding PPE must always be followed, regardless whether the PPE is shown in this manual or not. 无论本手册中是否显示 PPE，都必须始终遵守有关 PPE 的公司政策和当地法规。

2.1 Mechanical work 机械作业



Use eye, hand and hearing protection 使用眼睛、手和听力保护装置

Use protection for eyes, hand and hearing, if the mounting holes for bolts and heat sink need to be made. 如果需要制作螺栓和散热器的安装孔，请使用眼睛、手和听力保护装置。



Caution! 注意!

Risk of hand injury. 手部受伤风险

The IMD is heavy. Be careful with your hands when mounting the IMD in the cabinet.

IMD 很重。在变桨柜中安装 IMD 时，请小心您的手。

2.2 Electrical work 电气作业



Disconnect power 断开电源

Ensure that all power is disconnected when working with the IMD, except for during testing, commissioning and service. 在使用 IMD 时，除测试、调试和维修期间外，应确保所有电源都已断开。



Danger! 危险!

Risk of burns and electrical shock from short circuit, electrical arc and uninsulated wires.

Commissioning and maintenance work on this device may only be carried out by an instructed qualified electrician. 短路、电弧和未绝缘电线有灼伤和触电危险。该设备的调试和维护工作只能由有经验的合格电工进行。

- Live work is not permitted, except for during test, verification, commissioning, and service. 不允许带电作业，除非在维修、验证、调试和服务期间。
- Observe local regulation when working with electrical components. 使用电气元器件时，应遵守当地相关法规。
- When the IMD has been powered, there is a risk of stored energy even when the power is disconnected. Wait 5 minutes after the power is disconnected and verify zero energy according to company procedures on the outputs before performing any work. 在 IMD 已在 IMD 已通电的情况下，即使切断电源，也存在残余能量的风险。断开电源后等待 5 分钟，并按照公司的步骤验证输出能量为零后再进行任何工作。



Caution! 注意!

Risk of electrical shock from touch current if the protective earth is removed when the IMD is energized. 在 IMD 通电时，如果拆除保护接地，接触电流有触电危险。

Do not remove the protective earth is removed when the IMD is energized.

请勿在 IMD 通电时拆除保护接地。

2.3 Thermal precautions 热防护措施



Info 信息

During operation, the IMD can reach high surface temperatures. The temperature levels depend on the ambient temperature inside and outside the cabinet.

在运行期间，IMD 的表面温度可能会很高。温度等级取决于变桨柜内外的环境温度。



Warning! 警告!

Risk of severe burns.

The heat sink of the IMD can reach high temperature.

Do not touch until the surface (see pos. 1 in [Figure 1](#) on page [15](#)) is cooled down.

有严重烧伤的危险。

IMD 的散热器可以达到很高的温度。

在表面（参见第 13 页图 1 中的位置 1）冷却之前，请勿触摸。



Caution! 注意!

Risk of burns.

The sides of the IMD can reach medium high temperature.

Do not touch until the surface (see pos. 2 in [Figure 1](#) on page [15](#)) is cooled down.

有烧伤的危险。

IMD 的侧面可达到中高温。

在表面（参见第 13 页图 1 中的位置 2）冷却之前，请勿触摸。

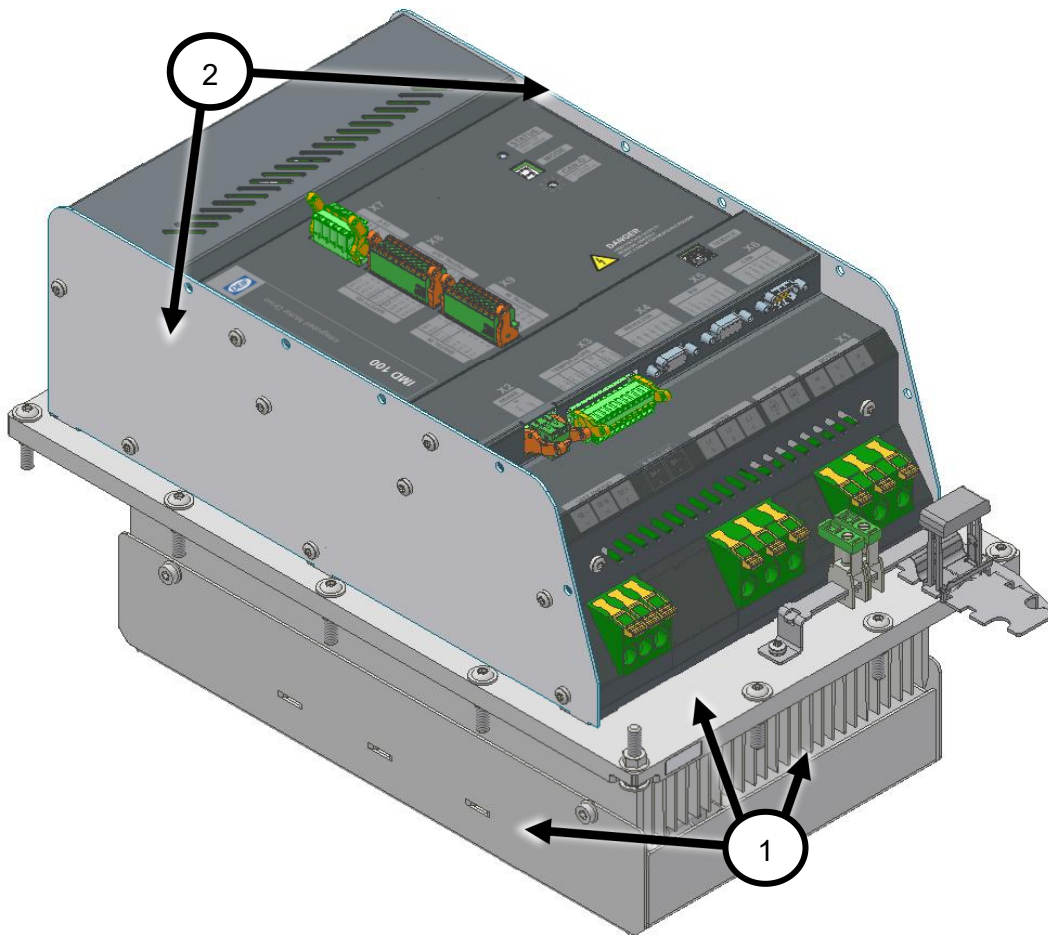


Figure 1 Hot surface areas 图 1 热表面区域

3. Avoiding damage to the IMD 避免损坏 IMD

Certain situations may result in product damage and should therefore be avoided by observing the precautions described in this section. These situations are not likely to occur under normal use of the IMD, but might occur in the lab or during service.

The situation list may not be comprehensive. Other, unknown situations that are not described in this section could occur.

某些情况可能会导致产品损坏，因此应通过遵守本节所述的预防措施来避免。在正常使用 IMD 时这些情况不太可能发生，但可能会发生在实验室或维修期间。

情况清单可能不全面。可能会发生本节未描述的其他未知情况。

3.1 Connecting the safe energy 连接后备电源

Possible damage: Damage to internal power components. **损坏可能性:** 内部电源组件损坏。



How to avoid:

If the safe energy was disconnected from the SE terminals, the mains supply must be turned on before the safe energy is turned on.

如何避免:

如果后备电源维护开关断开，则必须先接通主电源，然后再接通后备电源维护开关。

3.2 Switching mains ON and OFF 接通和断开电源

Possible damage: DC-link Pre-charge circuit damaged due to repeated MAINS ON and OFF operations

损坏可能性: 由于重复接通和断开电源操作，导致母线电压预充电电路损坏



How to avoid:

If the MAINS connections are switched ON and OFF more than once, wait 60 seconds before switching ON after switch OFF.

如何避免:

如果重复接通和断开电源操作，请在断电后等待 60 秒后再接通电源。

3.3 Overloading the ballast resistor 制动电阻过载

Possible damage: Ballast circuit ((switch or resistor) damaged due to overload. **损坏可能性:** 制动电路（开关或电阻）因过载而损坏。



How to avoid: 如何避免:

- The ballast resistor value is adequate for the DC-link Vmax. 制动电阻值足以满足最大母线电压值。
- Never use single pulse longer than 1 s during safe energy test. 在后备电源测试期间，切勿使用超过 1 秒的单脉冲。
- Wait 10 minutes (at 25°C) if the IMD is restarted and the ballast resistor has been

loaded (hot) . 如果 IMD 重启且制动电阻发热，则在 25℃ 的室温环境下等待 10 分钟后运行电机。

3.4 Connecting the mains with overvoltage 驱动器输入电源电压过高

Possible damage: Total damage to the IMD. 损坏可能性:IMD 完全损坏。



How to avoid:

The mains supply must never exceed the range specified in the Data sheet.

如何避免:

主电源电压不得超过数据表中规定的范围。

4. Mechanical integration 机械集成

This section describes the mechanical aspects of the IMD. See IMD 100 Datasheet for physical dimensions. 本节介绍 IMD 的机械方面。有关物理尺寸，请参阅 IMD 100 数据表。

4.1 Integrating the IMD in a cabinet 将 IMD 集成到变桨柜中

4.1.1 Safety requirements 安全要求

The IMD must be installed in a room or location to which access is restricted to skilled or instructed persons by the opening of a door or the removal of a barrier by the use of a key or tool and which is clearly marked by appropriate warning signs. 驱动器必须安装在技术人员或受过指导的人员通过使用钥匙或工具打开门或移除障碍物才能进入的房间或位置，并且该房间或位置必须清楚地标有适当的警告标志。

The heat sink (both in and out) can get hot depending on the ambient temperature and the activity of pitching the blade. If there is a risk of people touching the back of the IMD (the heat sink outside the cabinet) it is recommended to implement measures to protect personnel such as physical guards, information, or any other means. 散热器（内部和外部）可能变热，具体取决于环境温度和叶片变桨状况。如果存在人员接触 IMD 背面（变桨柜外的散热器）的风险，建议采取物理防护、信息保护等措施进行人身保护。

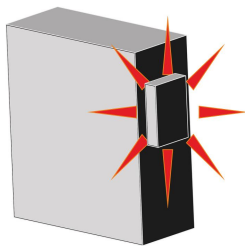


Figure 2 Risk of heat hazard

图 2 热危害风险

4.1.2 Environmental requirements 环境要求

The IMD must be mounted in a closed cabinet (minimum IPxxB) where the requirements for ingress protection of components inside the cabinet does not exceed IP 20.

The IMD heatsink is mounted through a hole in the cabinet and requirements for ingress protection outside the cabinet do not exceed IP 55 (IP 54 for IMD 122 B).

When designing the pitch system, pay attention to IMD location in the hub, to avoid debris entering the heatsink (1). Take the hub rotation into account, so that loose objects are not funnelled into the heatsink.

IMD 必须被安装在一个封闭的变桨柜中（最低 IPxxB），柜内部件的防护等级要求不超过 IP20。

IMD 散热器采用变柜内穿孔方式安装，柜外防护等级要求不超过 IP55 (IMD 122b 为 IP54)。

设计变桨系统时，请注意轮毂中的 IMD 位置，避免杂物进入散热器 (1)。将轮毂旋转考虑在内，以免松散的物体进入散热器。

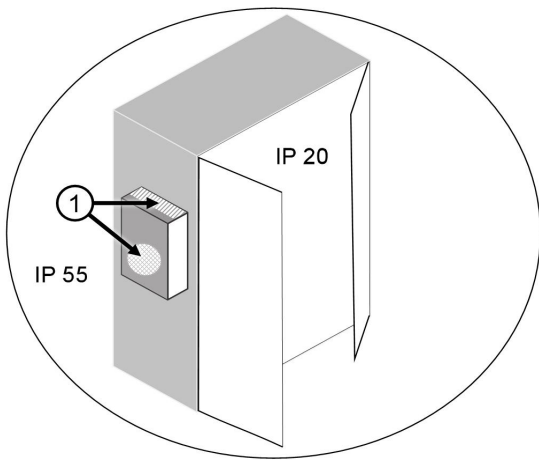


Figure 3 Environmental requirements and considerations 图 3 环境要求和注意事项

For other environmental requirements, see *IMD 100 Datasheet*. 其他环境要求见 IMD 100 数据表。

4.1.3 Temperature considerations 温度注意事项

This section describes the considerations concerning temperature and ventilation when designing the cabinet in which the IMD is placed, and the location of the cabinet. 本节介绍了设计安装 IMD 的变桨柜时，有关温度和通风条件的注意事项，以及机柜的位置。

4.1.3.1 Cabinet cooling considerations 变桨柜冷却注意事项

The ambient temperature range defined in the *IMD 100 Datasheet* must be maintained at all times. This also applies inside the cabinet, where the IMD itself also contributes with heat radiation, mainly because part of the heat sink is located inside the cabinet. The IMD shuts down the output drive at 90 °C, thereby the heat sink temperature will never exceed 90 °C.

必须始终保持 IMD 100 数据表中规定的环境温度范围。这也适用于变桨柜内部，IMD 本身也会产生热辐射，主要是因为部分散热器位于变桨柜内部。IMD 在 90 °C 时会关闭输出驱动，因此散热器温度永远不会超过 90 °C。

IMD 122:

[Figure 4](#) on page [19](#) shows the heat radiation of the IMD inside the cabinet as a function of the heat sink temperature. At this temperature, the heat contribution from the IMD inside the cabinet is approximately 69 W.

第 [19](#) 页的图 4 显示了变桨柜内 IMD122 的热辐射随散热器温度的变化。在此温度下，变桨柜内 IMD 产生的热量约为 69 W。

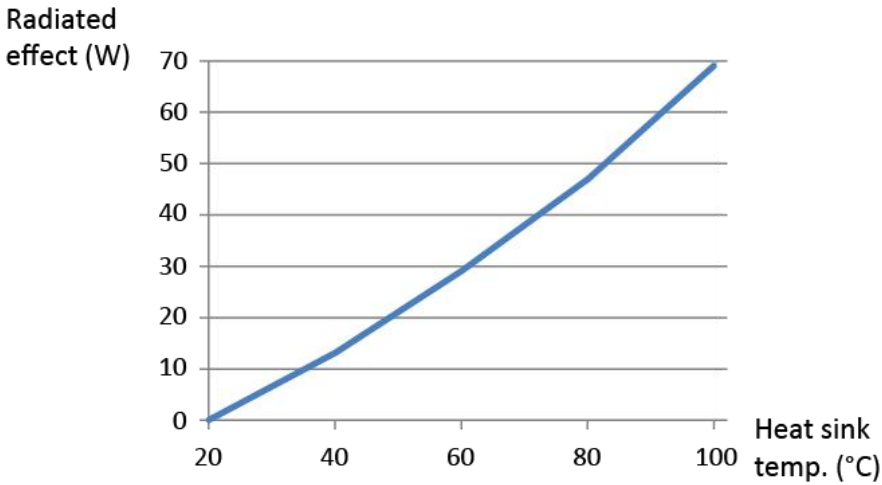


Figure 4 Radiated heat from the IMD inside the cabinet

图 4 变桨柜内部 IMD 散热示意图

IMD 135:

[Figure 5](#) on page [19](#) shows the heat radiation of IMD 135 inside the cabinet as a function of the heat sink temperature. At this temperature, the heat contribution from the IMD inside the cabinet is approximately 81 W.

第 [19](#) 页的图 5 显示了变桨柜内 IMD 135 的热辐射随散热器温度的变化。在此温度下，机柜内 IMD 产生的热量约为 81 W。

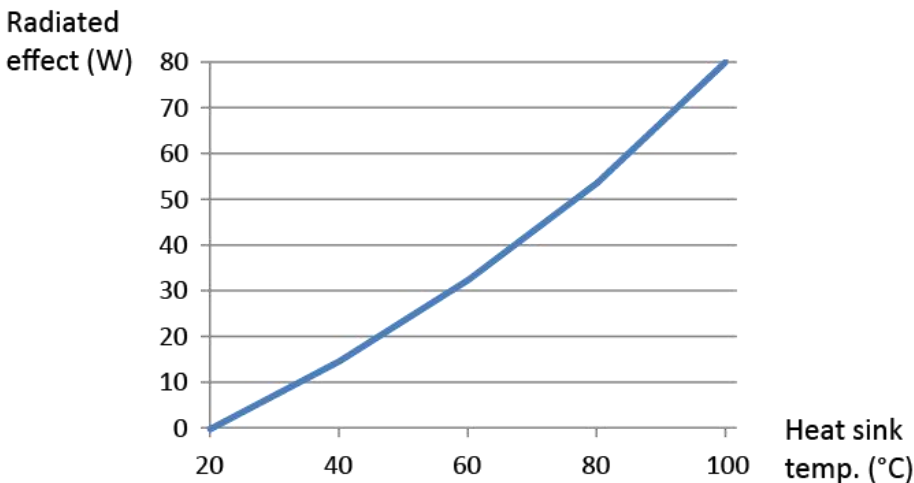


Figure 5 Radiated heat from the IMD inside the cabinet

图 5 变桨柜内部 IMD 散热示意图

4.1.3.2 Free space around the IMD 驱动器周围的空余空间

Outside the cabinet, keep free space around the IMD at least as shown in [Figure 6](#) on page [20](#) (IMD 122 C), [Figure 7](#) on page [21](#) (IMD 122 B) and [Figure 8](#) on page [21](#) (IMD 135). There must be adequate ventilation in this space.

Inside the cabinet, keep at least 20 mm free space from the sides of the IMD and 80 mm free space from top and bottom of the IMD. There must be adequate ventilation in this space.

在变桨柜外，至少应按照第 [20](#) 页的图 6 (IMD 122 C)、第 [21](#) 页的图 7 (IMD 122 B) 和第 [21](#) 页的图 8 (IMD 135) 中所示的方式在 IMD 周围预留空余空间。这个空间必须有足够的通风。

在机柜内部，IMD 侧面至少预留 20mm 空间，IMD 顶部和底部至少预留 80mm 空间。这个空间必须有足够的通风。

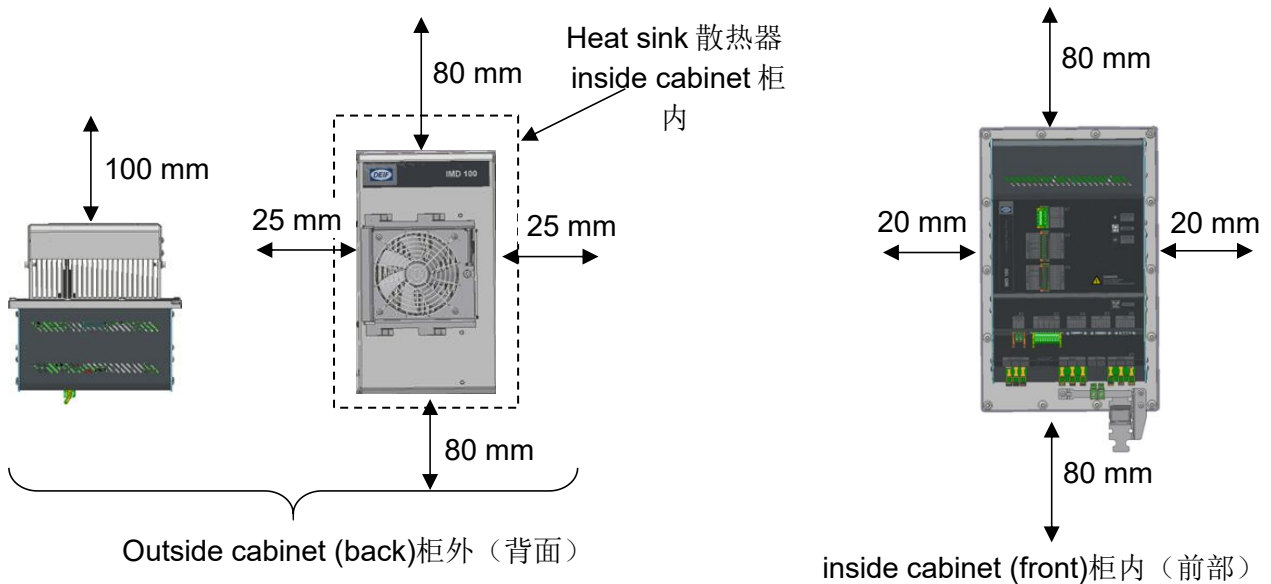


Figure 6 IMD 122 C free space requirements

图 6 IMD 122 C 空余空间要求

Note for IMD 122 C: The 100 mm indicated is recommended to enable easy replacement of the fan. The minimum requirement due to temperature is 50 mm. 驱动器 IMD 122 C 的注意事项：可用空间建议为如下所示的 100 毫米以方便更换风扇。由于温度原因，最小要求为 50 毫米。

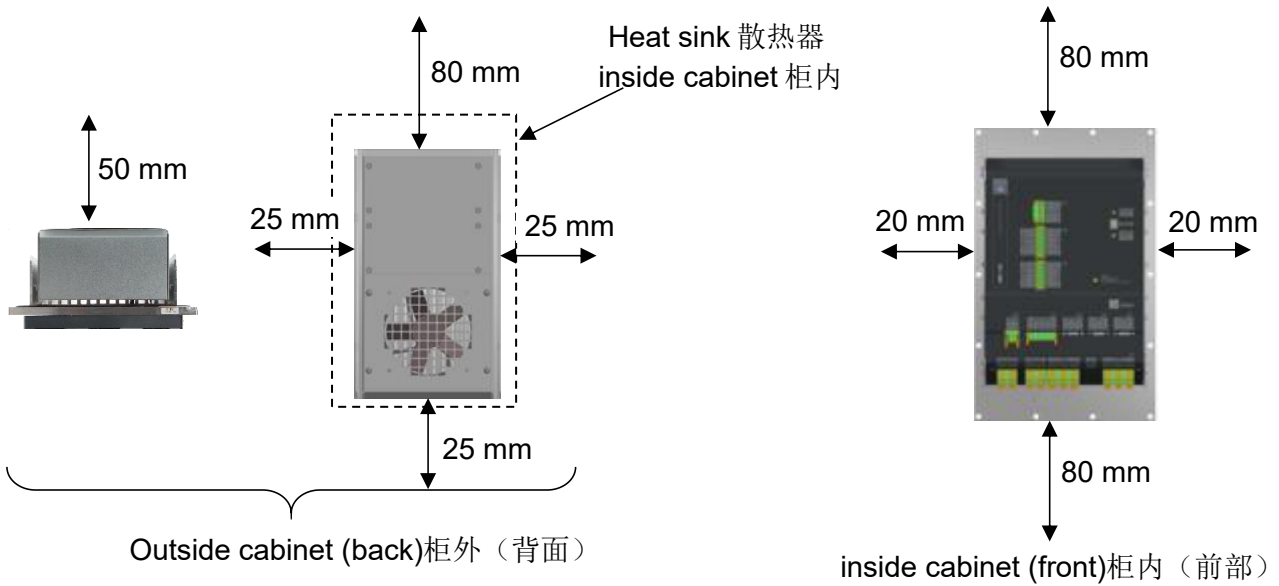


Figure 7 IMD 122 B free space requirements

图 7 IMD 122 B 空余空间要求

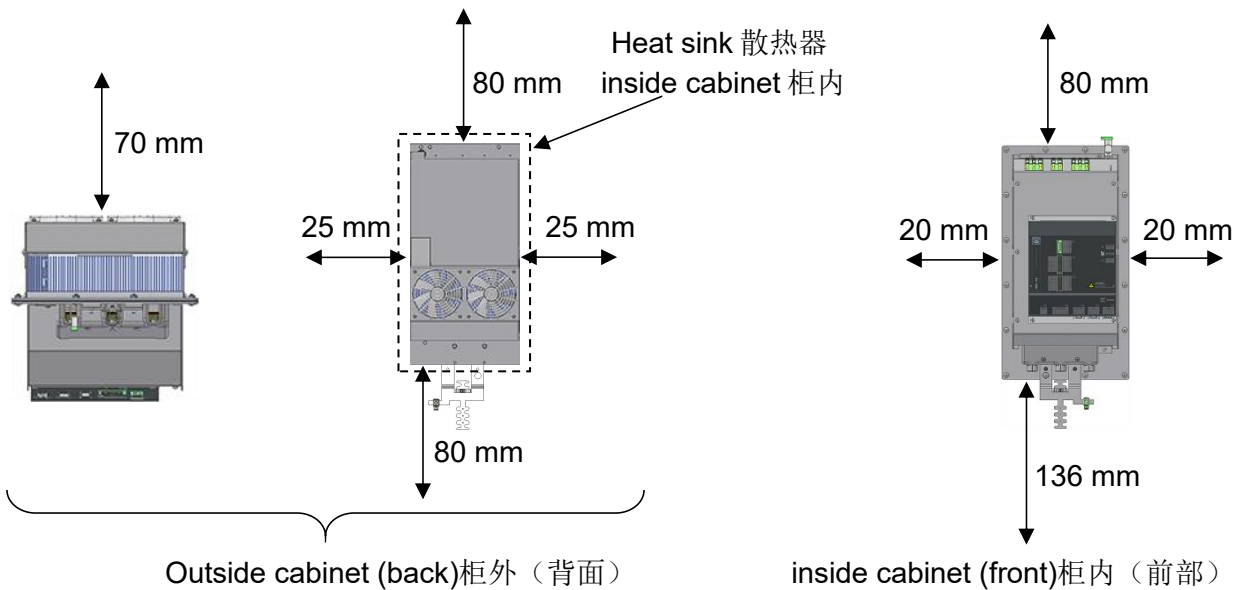


Figure 8 IMD 135 C free space requirements

图 8 IMD 135 C 空余空间要求

Note for IMD 135: Consider the outside space (25 mm) around the IMD with regards to fan replacement.

IMD 135 的注意事项：在更换风扇时考虑 IMD 周围的外部空间 (25 mm)。

4.1.4 Mounting of the IMD in the cabinet 在变桨柜中安装 IMD

A rectangle hole and 14/16 x $\varnothing 7$ mm holes for M6 bolts must be made in the cabinet where the IMD is to be mounted. 需要在 IMD 所在的变桨柜上为 M6 螺栓开一个矩形孔和 14/16 $\times \varnothing 7$ mm 孔。

The holes for the bolts and heat sink are to be made according to the following drawing: 螺栓和散热器的孔按下图制作:

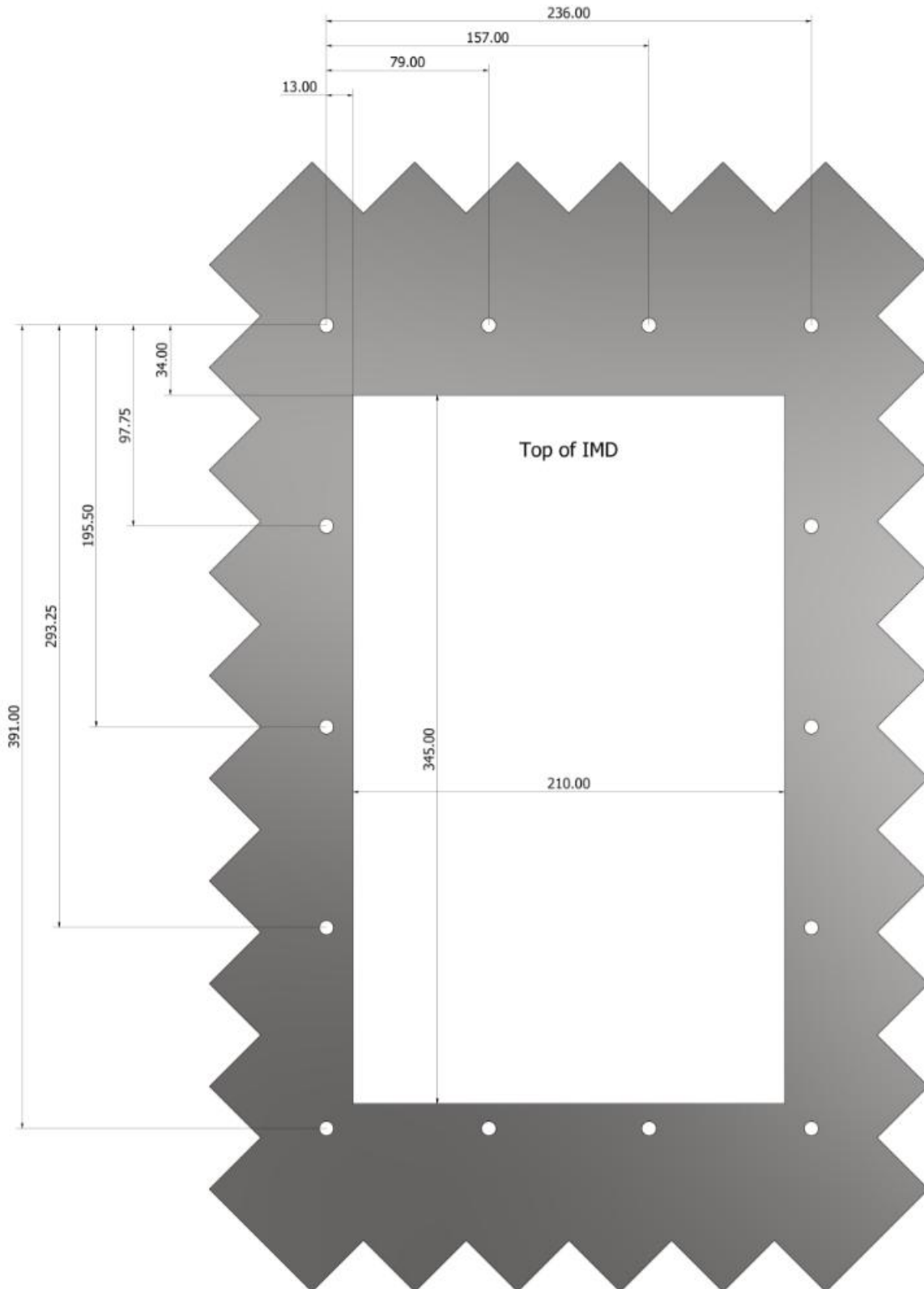


Figure 9 Cabinet cut-out drawing for IMD 122 图 9 IMD122 变桨柜开孔图

图 9 IMD 122 变桨柜开孔图

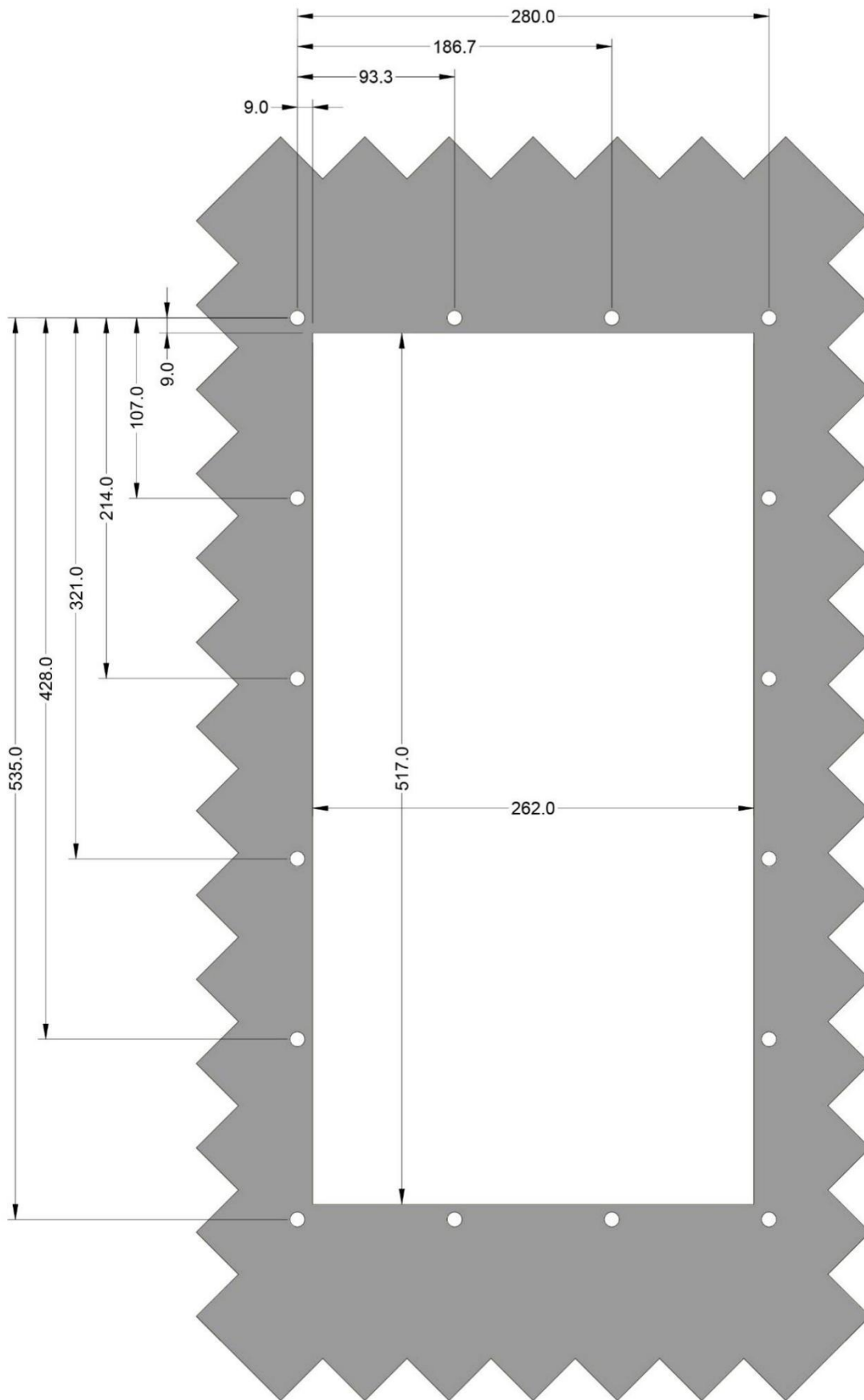


Figure 10 Cabinet cut-out drawing for IMD 135 图 10 IMD135 变桨柜开孔图

Ensure there are no sharp edges that can harm the workers who will mount the IMD. 确保没有锋利的边缘会伤害到安装 IMD 的工人

A gasket seal at the back of the IMD ensures tight assembly (122 B: IP 54, 122 C / 135 C: IP 55)) as shown in the following figure (pos. 1). Fan housing might differ from the shown figure.

IMD 背面的垫圈密封可确保紧密组装（122 B：IP 54、122 C / 135 C：IP 55），如下图（位置 1）所示。风扇外壳可能与图示不同。

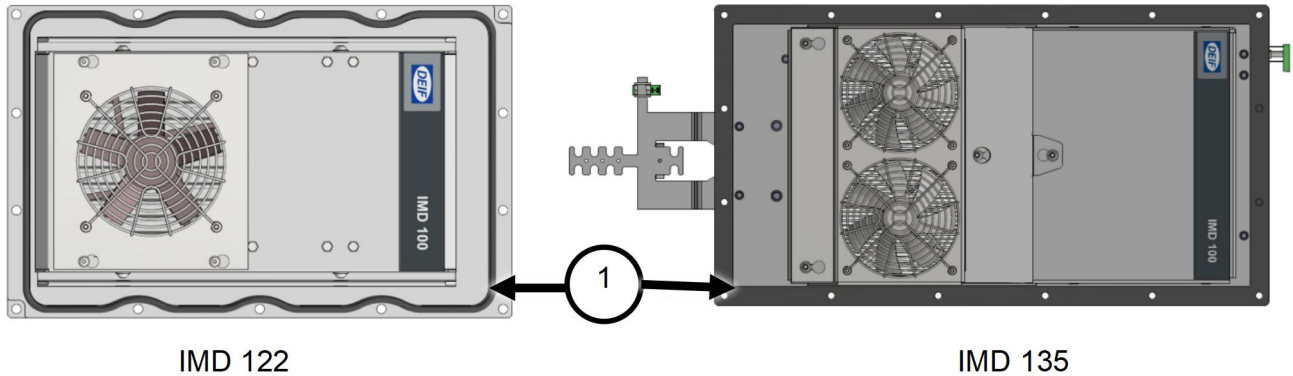


Figure 11 Gasket seal at the back of the IMD

图 11 IMD 背面的垫圈密封

In order to ensure that the gasket is properly compressed, the optional mounting frame can be used. All needed material is delivered in the package, and it is possible for one person to mount the IMD in a cabinet. See *the IMD 100 Installation instructions* for the installation procedure using the mounting frame. 为了确保垫圈被正确压缩，可使用选装安装支架。所有需要的材料都在包装中交付，一个人就可以将 IMD 安装在变桨柜中。有关使用安装支架的安装步骤，请参阅 IMD 100 安装说明。

If the mounting frame is not used, it is recommended to use 14 pcs. M6 mm bolts and M6 nuts to fix the IMD in place. Use serrated washers to ensure that bolts do not open unintentionally due to vibrations and extensive temperature changes. Ensure that the necessary torque is applied to the bolts and nuts to ensure a tight assembly, and that the cabinet wall is adequately rigid to ensure proper mounting. 如果不使用安装支架，建议使用 14 个 M6 mm 螺栓和 M6 螺母将 IMD 固定到位。使用锯齿垫圈确保螺栓不会因振动和温度剧烈变化而意外打开。对螺栓和螺母施加必要的扭矩，以确保装配紧密，并使变桨柜墙壁具有足够的刚性，以确保正确安装。



Info 信息

Be aware that the *IMD 100 Installation instructions* does not describe in details the mounting procedure if the mounting frame is not used.

请注意，如果未使用安装支架，IMD 100 安装说明没有详细说明安装过程。

5. Electrical HW connections and requirements 电气硬件 连接和要求

This section describes in details the electrical requirements for all terminations of the IMD. 本节详细描述了 IMD 的所有端子的电气要求。

The following figures illustrates the variants of the IMD with their HW functions: 下图显示了 IMD 的不同版本及其硬件功能:

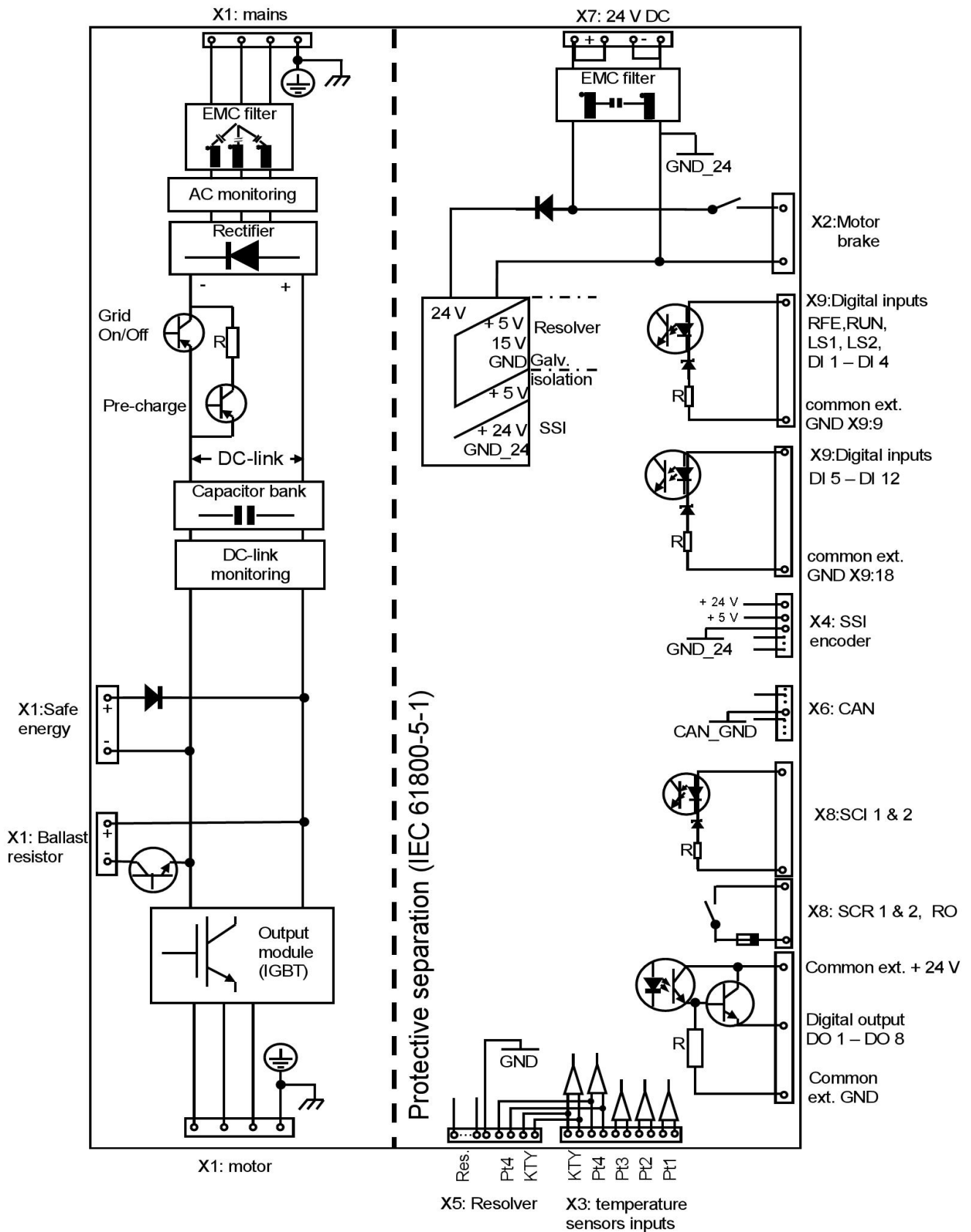


Figure 12 IMD 122 B

图 12 IMD 122 B

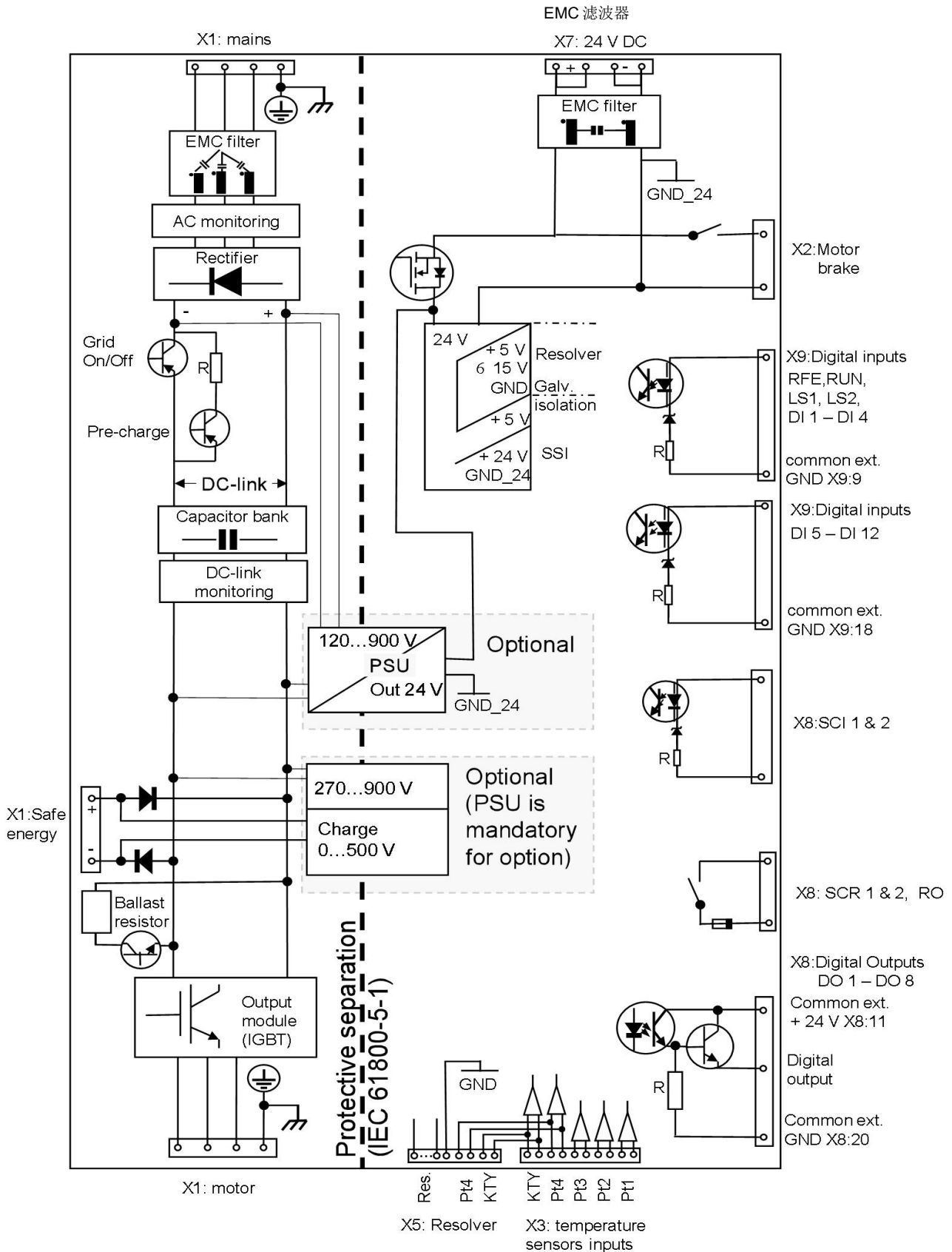


Figure 13 图 13: IMD 122 C / 135 C

All connectors in the IMD (with the exception of the earth terminal) are push-in spring connectors, which can withstand the constant vibration in a wind turbine while keeping a good electrical connection as well as providing for fast installation process. Except for the power connections (X1) all connectors are male-female (removable) connectors that makes it possible to make wiring sets for production, thus enabling fast assembly.

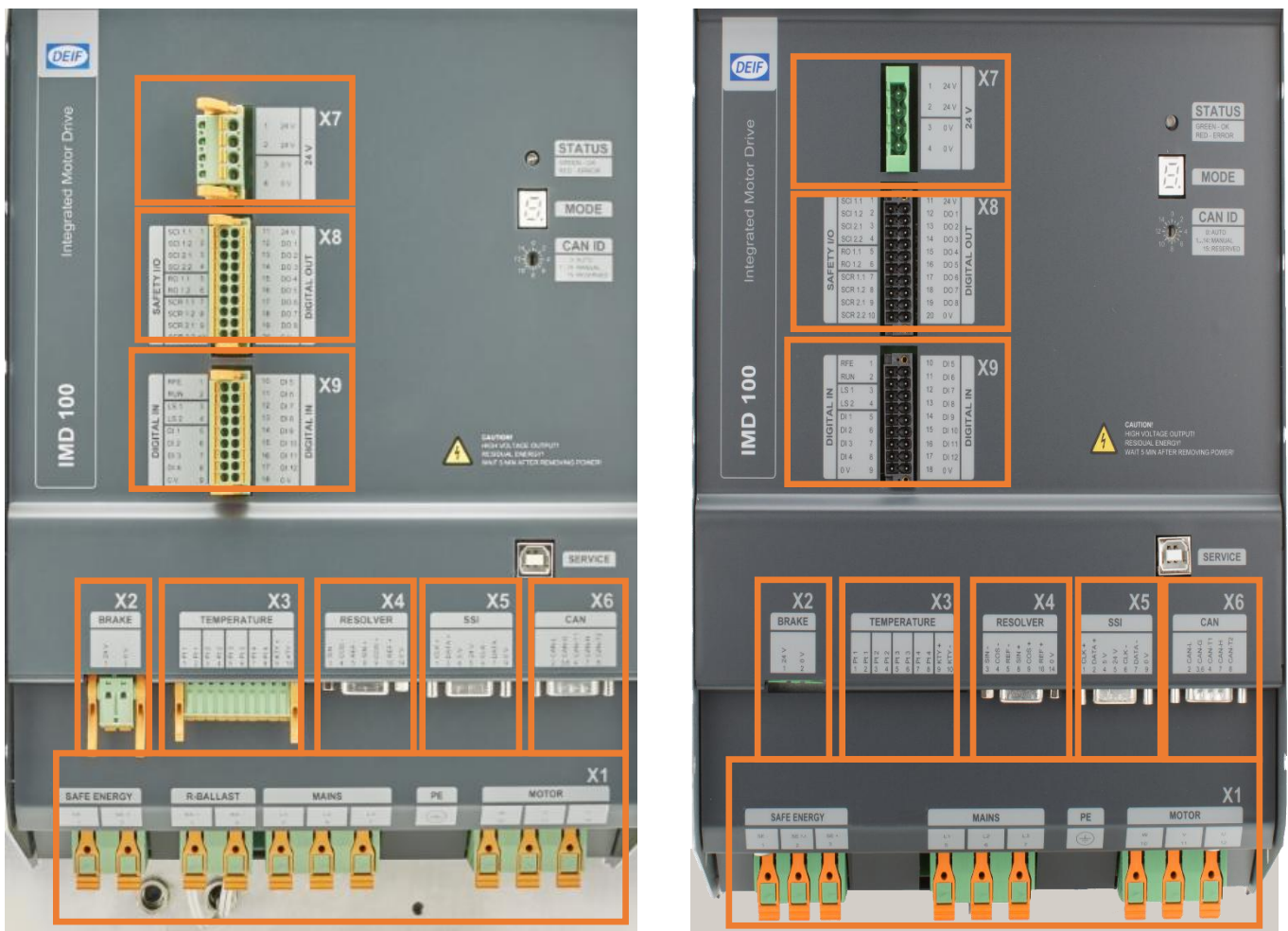
For detailed description of how to use the different connectors and the specific safety precautions needed to be taken, see the *IMD 100 Installation instructions*.

Following is an overview of the connections that need to be made.

IMD 的所有连接器(接地端子除外)都是推入式弹簧连接器, 可以承受风力发电机的持续振动, 同时保持良好的电气连接, 并提供快速安装过程。除电源连接(X1)外, 所有连接器都是公母(可拆卸)连接器, 这使得生产批量接线成为可能, 从而实现快速组装。

IMD 100 连接器的具体使用方法及安全注意事项, 请参见《IMD 100 安装指导书》。

以下是需要接线的示意图。



IMD 122 B

IMD 122 C

Figure 14 IMD 122 connections overview 图 14 IMD 122 连接示意图

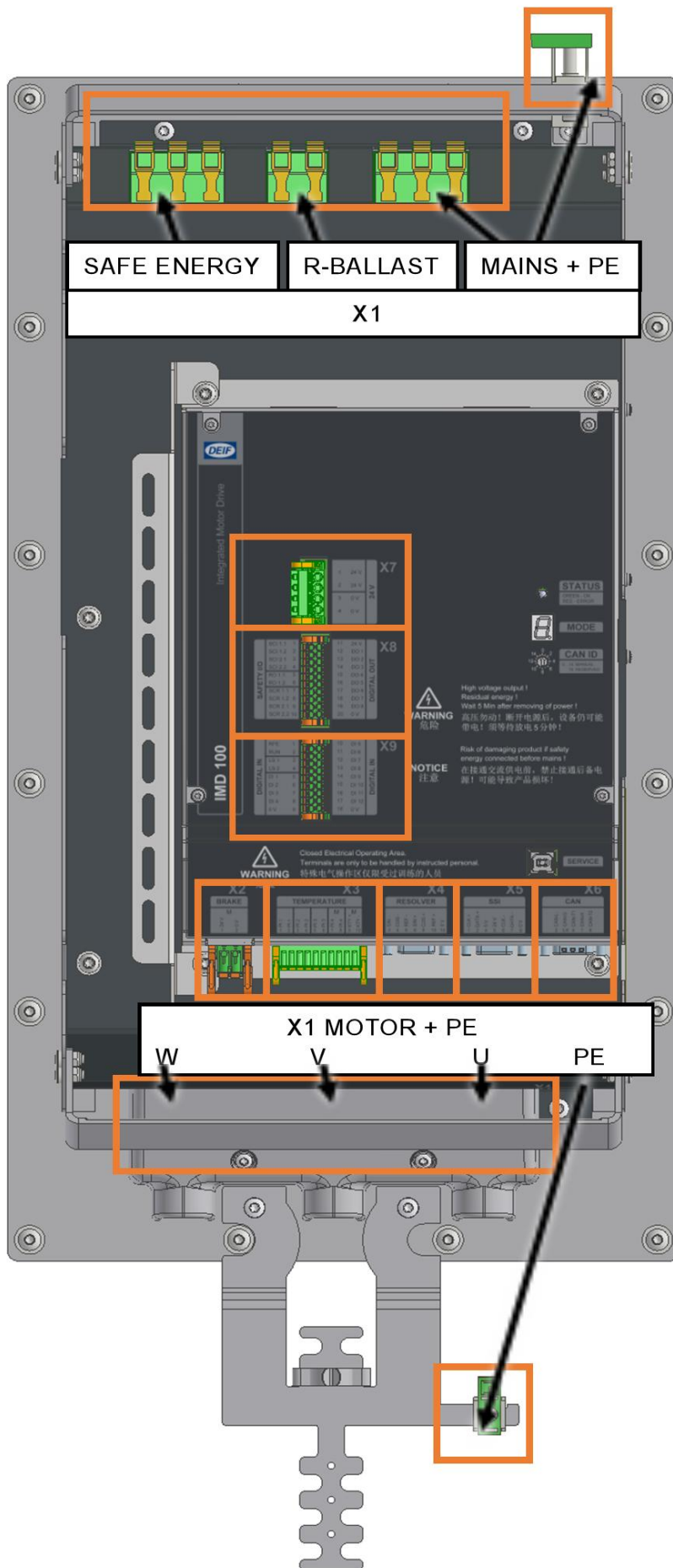


Figure 15 IMD 135 C connections overview 图 15 IMD 135C 连接示意图

The types of connectors used in the IMD are listed in the following table:IMD 中使用的连接器类型如下表所示:

Table 1 表 1 IMD connector types IMD 连接器类型

Connector type on IMD IMD 上的连接器类型	IMD connector designation IMD 连接器名称	Direct / removable connector 直接/可拆卸连接器
Phoenix PLH 16	X1	Directly to connector 直接连接到连接器
M8 threaded rod with nuts (IMD 135 only) 带螺母的 M8 螺纹杆 (IMD 135 专用)	X1 (MOTOR) X1 (电机)	Directly to connector 直接连接到连接器
Phoenix SPT 2.5 (IMD 122 C with external ballast resistor option) (带有外部制动电阻选项的 IMD 122 C)	X1 (R-BALLAST) X1(制动电阻)	Directly to connector 直接连接到连接器
M5 threaded rod with nuts (IMD 122 A, B, C early production) 带螺母的 M5 螺纹杆 (早期生产的 IMD 122 A、B、C)	X1 (PE terminal) X1PE 端子	Direct (PE/Earth) 直接 (PE/接地)
Phoenix AKG 16 GN (IMD 122 C / IMD 135 C)	X1 (PE terminals) X1 (PE 端子)	Direct (PE/Earth)直接 (PE/接地)
Phoenix FK-MCP 2,5	X2, X7	Connected through removable connector 通过可拆卸连接器连接
Phoenix FK-MCP 1,5	X3, X8, X9	Connected through removable connector 通过可拆卸连接器连接
15 pole Sub-D female 15 针 Sub-D 母头	X4	Connected through removable connector 通过可拆卸连接器连接
9 pole Sub-D female 9 针 Sub-D 母头	X5	Connected through removable connector 通过可拆卸连接器连接
9 pole Sub-D male 9 针 Sub-D 母头	X6	Connected through removable connector 通过可拆卸连接器连接

Due to the use of spring-loaded connectors, the use of ferrules (termination sleeves) is optional. However, ferrules must be used if more than one wire is connected to the same connector. Follow the ferrule manufacturer instruction on how to use a ferrule. The following table lists the technical specifications for the used Phoenix connectors:

由于使用弹簧式连接器，因此可选择使用套圈（端接套管）。但是，如果多条电线连接到同一连接器，则必须使用套圈。遵循套圈制造商关于如何使用套圈的说明。下表列出了所用 Phoenix 连接器的技术规格：

Table 2 表 2 Phoenix connector's technical data 表 2 Phoenix 连接器的技术数据

	PLH 16	SPT 2.5	FK-MCP 1.5	FK-MCP 2.5
Conductor cross section flexible, without ferrule 导体横截面柔韧，无套圈	0.75 – 25 mm ²	0.2 – 2.5 mm ²	0.14 – 1.5 mm ²	0.2 – 2.5 mm ²
Conductor cross section flexible, with ferrule without plastic sleeve 导体横截面柔韧，带套圈，不带塑料套管	0.75 – 16 mm ²	0.25 – 2.5 mm ²	0.25 – 1.5 mm ²	0.25 – 2.5 mm ²
Conductor cross section flexible, with ferrule with plastic sleeve 导体横截面柔韧，带塑料套管的套圈	0.75 – 10 mm ²	0.25 – 1.5 mm ²	0.25 – 0.5 mm ²	0.25 – 2.5 mm ²
Stripping length (without ferrule)剥线长度（不含套圈）	18 mm	10 mm	9 mm	10 mm
Ferrule length 套圈长度	18 mm	10mm	10 mm	10 mm
Rated voltage 额定电压	1000 V	400 V	160 V	320 V
Rated current 额定电流	76 A	24 A	8 A	12 A

5.1 Shielding and EMC 接地和 EMC

If the IMD is used in a wind turbine or any other environment where EMC (ElectroMagnetic Compatibility) protection is required, shielding from cabinet to cabinet (or cabinet to unit) is required. In such cases the cable shielding is connected directly to PE and cabinet earthing, and may not be used for anything else (such as CAN GND). The EMC protection shielding is though also effective as shielding against interference to the signal wires. In essence, any cable from outside the cabinet is shielded, and the shield needs to be connected to PE. It is important that these cable shields are connected to both cabinet (through EMC glands) and the IMD (through the connector housing or any other means).

如果 IMD 应用于风力发电机或任何其他需要 EMC（电磁兼容性）保护的环境，则机柜到机柜（或机柜到机组）之间需要进行屏蔽。在这种情况下，屏蔽电缆需直接连接到 PE 和机柜接地，不得用于任何其他用途（如 CAN GND）。EMC 保护屏蔽也可以有效地屏蔽信号线的干扰。本质上，机柜外部的任何电缆都是屏蔽的，屏蔽电缆需要连接到 PE 上。务必将这些屏蔽电缆连接到机柜（通过 EMC 密封套）和 IMD（通过连接器外壳或任何其他方式）。

Requirements for cables: any cables going through the cabinet walls must be shielded and the shields must be connected to PE.

电缆要求：任何穿过机柜壁的电缆都必须屏蔽，并且屏蔽必须连接到 PE 上。

The following illustration illustrates the principle of the protection: 下图说明了保护原理:

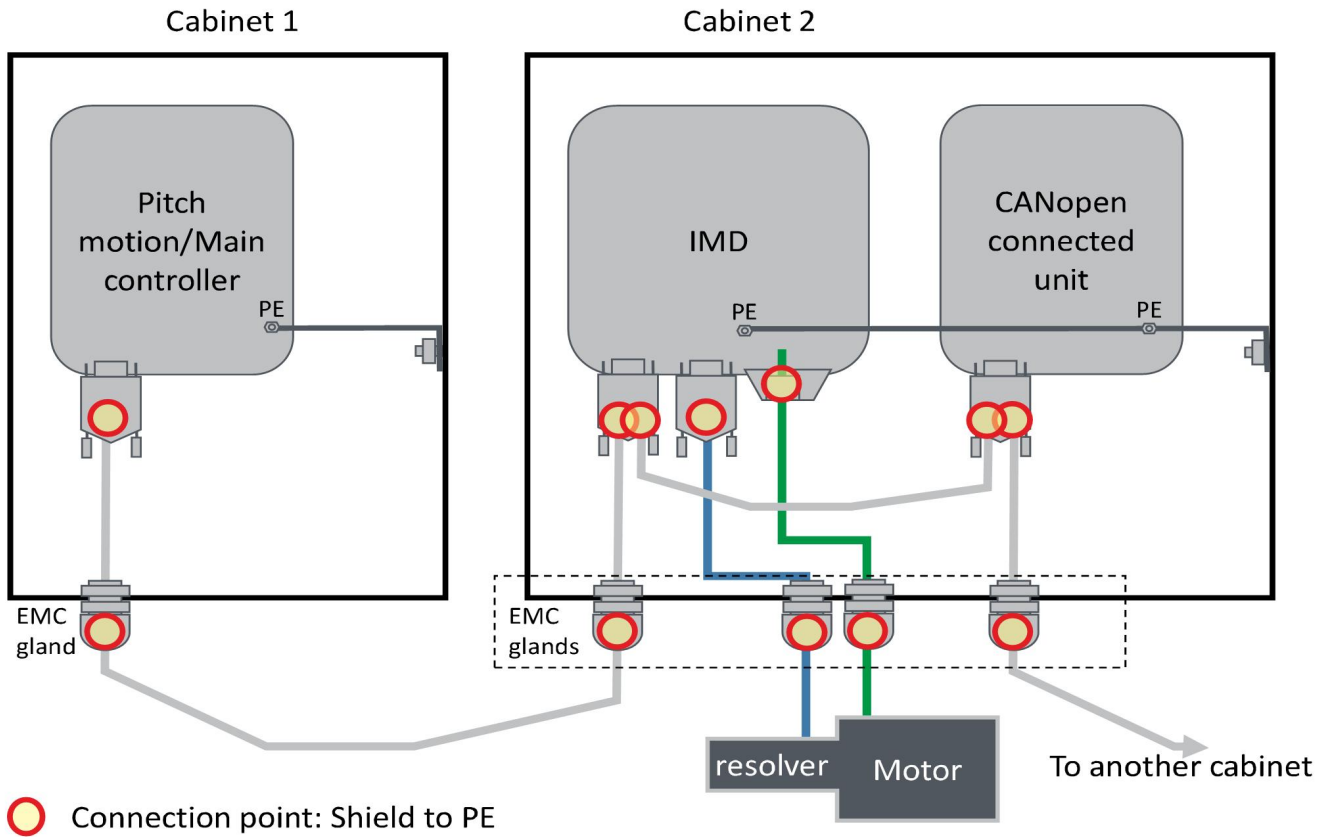


Figure 16 Cable shielding example

图 16 电缆屏蔽示例

The following figure illustrates how the two types of connections are realized in a connector. Since there are different types of connectors and cables, this illustration is an example only.

下图说明了如何在连接器中实现这两种类型的连接。由于有不同类型的连接器和电缆，因此本图仅为示例。

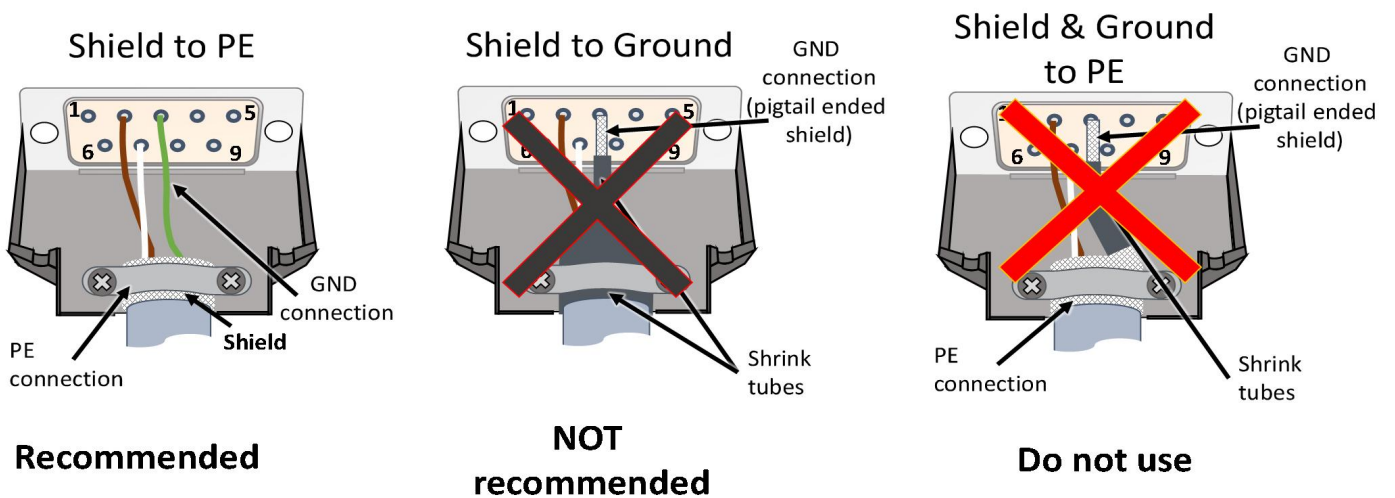


Figure 17 Realization of shielding in connectors 图 17 连接器屏蔽正确接法

**Attention 注意**

The use of shield to ground (with a pigtail) is not recommended.

Do not use shield to ground (with a pigtail) and to PE

不推荐使用屏蔽接地（带尾纤）。

不要将屏蔽接地（带尾纤），也不要将屏蔽接到 PE 上

5.2 Power connections (X1) 电源连接(X1)**Danger! 危险!**

Risk of burns and electrical shock from short circuit, electrical arc and uninsulated wires.

Live work is not permitted, except for during commissioning and service.

Observe local regulation when working with electrical components.

短路、电弧和未绝缘的电线会导致灼伤和电击危险。

不允许带电作业，调试和维修期间除外。

使用电子元器件时，请遵守当地法规。

**Disconnect power 断开电源**

Ensure that all power is disconnected when connecting cables to the IMD. If the IMD was powered, wait at least 5 minutes after the power is disconnected, due to residual voltage in the IMD.

将电缆连接到 IMD 时，确保断开所有电源。如果 IMD 已通电，由于 IMD 中存在残余电压，请在断开电源后至少等待 5 分钟再操作。

Phoenix PLH16 connector is used for connections in X1 (direct connector).

Phoenix SPT 2.5 connector is used for R-BALLAST connections in IMD 122 C equipped with External ballast resistor option.

Phoenix PLH16 连接器用于 X1 中的连接（直接连接器）。

Phoenix SPT 2.5 连接器用于配备外部制动电阻选项的 IMD 122 C 中的 R-镇流器连接。

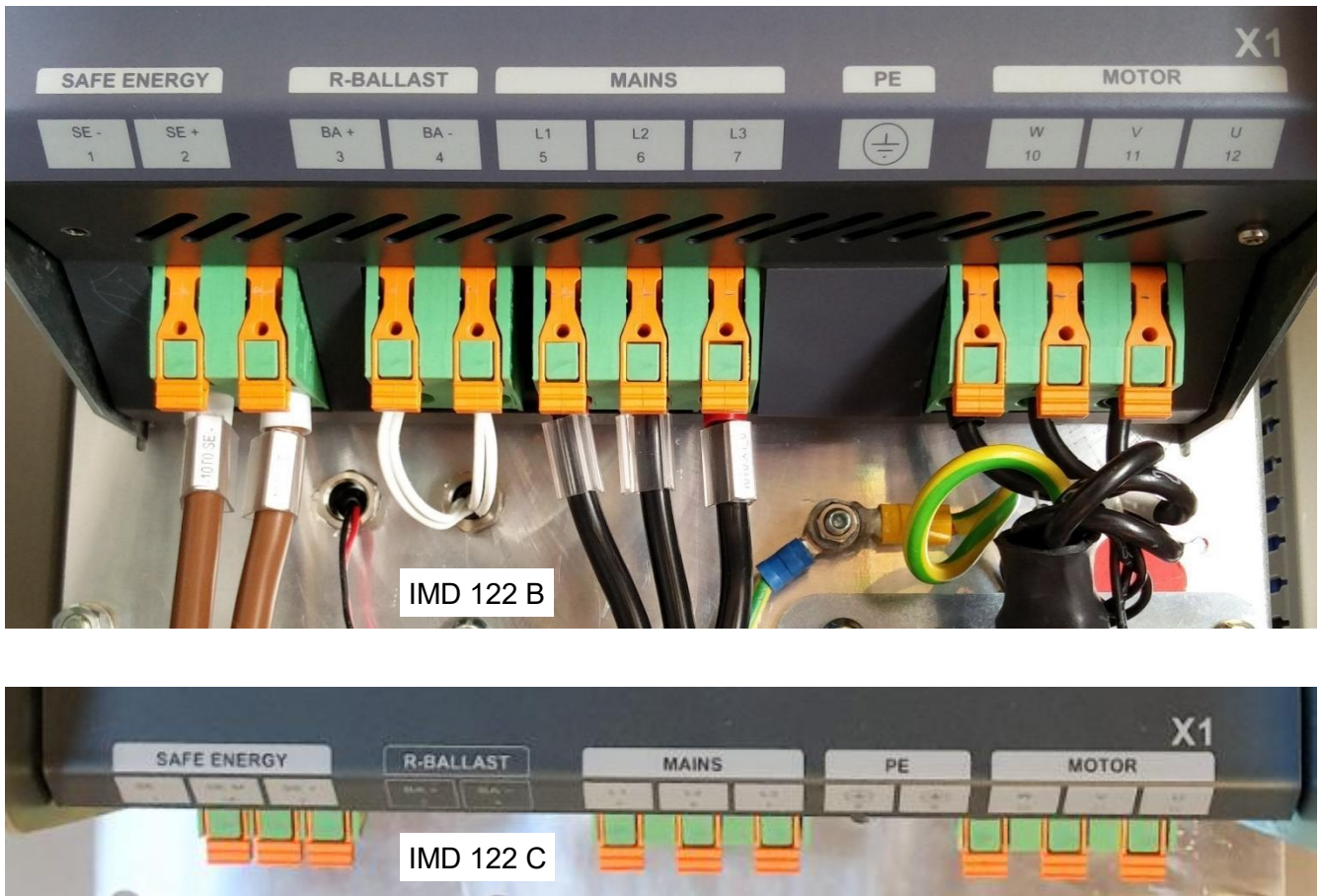


Figure 18 X1 connections IMD 122

图 18 X1 连接 IMD 122



Figure 19 X1 connections IMD 135 C

图 19 X1 连接 IMD 135 C

5.2.1 Motor connections requirements 电机连接要求

The motor connections are the output from the IMD to the motor.

The requirements for the motor used with the IMD are listed in the following table:

电机连接是 IMD 到电机的输出。

与 IMD 配套使用的电机要求如下表所示:

Table 3 Motor requirements

表 3 电机要求

Motor type 电机种类	<ul style="list-style-type: none"> Synchronous 3 phases AC motor 三相同步交流电机 Asynchronous 3 phases AC motor 三相异步交流电机 DC motor 直流电机
Insulation 绝缘	<ul style="list-style-type: none"> Adequate for the voltage of the Mains input 满足电源输入的电压 Adequate for non-sinusoidal waveform of the IMD output 满足 IMD 输出的非正弦波形
Resolver 编码器	<p>Frequency: 10 kHz 频率: 10 kHz</p> <p>Voltage: 7 V AC pp 电压: 7v AC pp</p> <p>No. of poles: 2 to 8 极数: 2 至 8</p>
Built-in temperature sensor 内置温度传感器	<p>Pt100, KTY 84 or PTC*, double insulated</p> <p>Pt100、KTY 84 或 PTC*, 双重绝缘</p>
Built-in brake 内置制动器	<p>Voltage: 24 ± 10% V DC 电压: 24 ± 10%V 直流电</p> <p>Current: Maximum 5 A 电流: 最大 5 A</p>
Maximum cable length 最大电缆长度	10 m

* If PTC sensor is used the following IMD functions are not available: 如果使用 PTC 传感器, 则以下 IMD 功能不可用:

- High motor temperature warning 电机温度过高警告
- Actual motor temperature reading (only motor temperature too high error) 实际电机温度读数 (仅电机温度过高错误)



Info 信息

Long temperature sensor's wires will impact the accuracy of the temperature measurements.

温度传感器导线过长会影响温度测量的准确性。

Motor cable requirements: 电机电缆要求:

The motor cable must be shielded. If any other cables (for example for the brake or the temperature sensor) are inside the same cable they must be shielded separately. 电机电缆必须屏蔽。如果任何其他电缆 (例如用于制动器或温度传感器) 位于同一条电缆内, 则必须将它们分开屏蔽。

The following figure illustrates an example of a cable containing the motor, brake, and temperature sensor connections. 下图显示了包含电机、制动器和温度传感器连接的电缆示例。

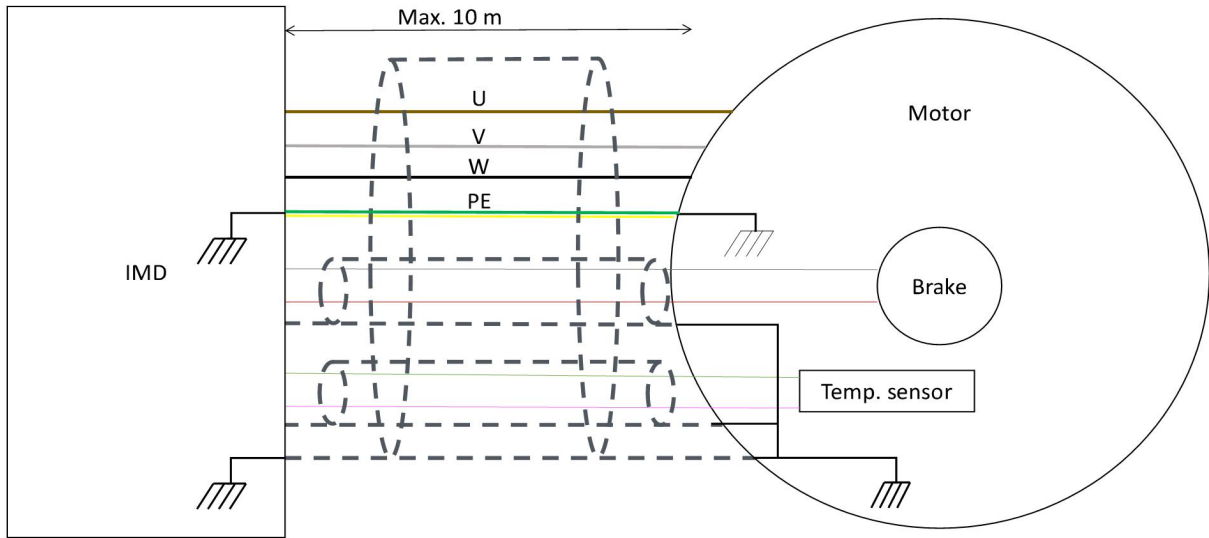


Figure 20 Requirements for motor cable shielding (example)

图 20 电机电缆屏蔽要求（示例）

Wire and cable constraints: 电线电缆限制:

Brake: 制动器

The brake wires are typically part of the motor cable. They are connected to X2, see constraints on wire cross section in [Table 2](#) on page [30](#) (FK-MCP 2.5).

制动导线通常是电机电缆的一部分，与 X2 相连，见第 [30](#) 页表 2 中的导线横截面限制（FK-MCP 2.5）。

Motor phase: 电机相线:

Phase wires IMD 122 B/C: See [Table 2](#) on page [30](#) (PLH 16) for suitable wire cross section.

Phase wires IMD 135 C: Use 8 mm cable lugs (not delivered) appropriate for the cross section of the wire used. The lug's width must not exceed 18 mm.

相线 IMD 122 B/C: 有关合适的导线横截面，请参见第 [30](#) 页的表 2（PLH 16）。

相线 IMD 135 C: 使用 8 mm 电缆接线头（未交付），适用于所用导线的横截面。接线头的宽度不得超过 18 mm。

Protective earth:

The protective earth wire is connected to X1, PE terminal.

IMD 122 C, IMD 135 C: Phoenix AKG 16 GN flat screws terminal.

IMD 122 B and early production of IMD 122 C: M5 threaded rod with nuts and washers. Suitable cable lugs for the used wires (not delivered) are needed for the connection.

保护接地:

保护接地线连接至 X1, PE 端子。

IMD 122 C、IMD 135 C:Phoenix AKG 16 GN 平螺钉端子。

IMD 122 B 和早期生产的 IMD 122 C:带螺母和垫圈的 M5 螺纹杆。连接时需要与所用电线(未交付)配套的电缆接头。

Shield: 屏蔽

The shield clamps have the following specifications for the shield diameter:

IMD 122 B/C: 6 to 20 mm

IMD 135 C: 23 to 29 mm

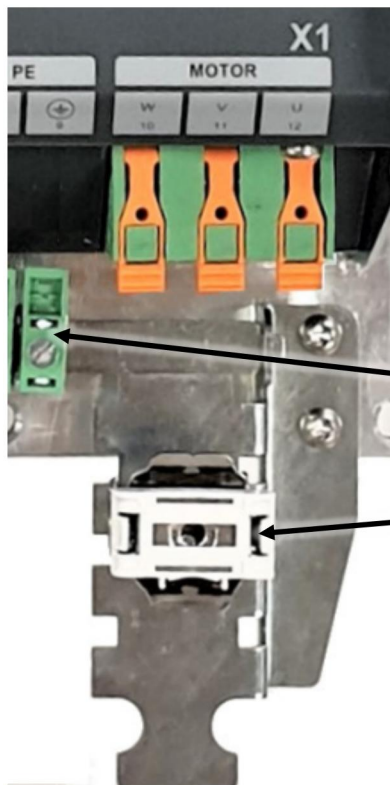
屏蔽夹的屏蔽直径规格如下:

IMD 122 B/C: 6 至 20 毫米

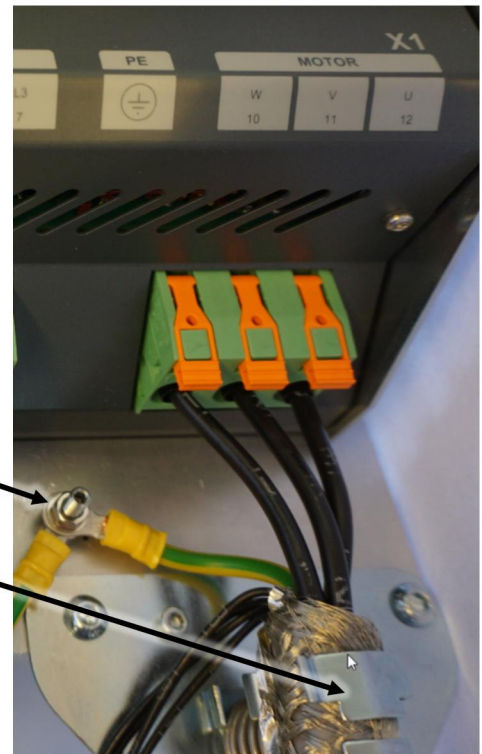
IMD 135 C:23 至 29 毫米

The wires from the motor cable are connected as follows:

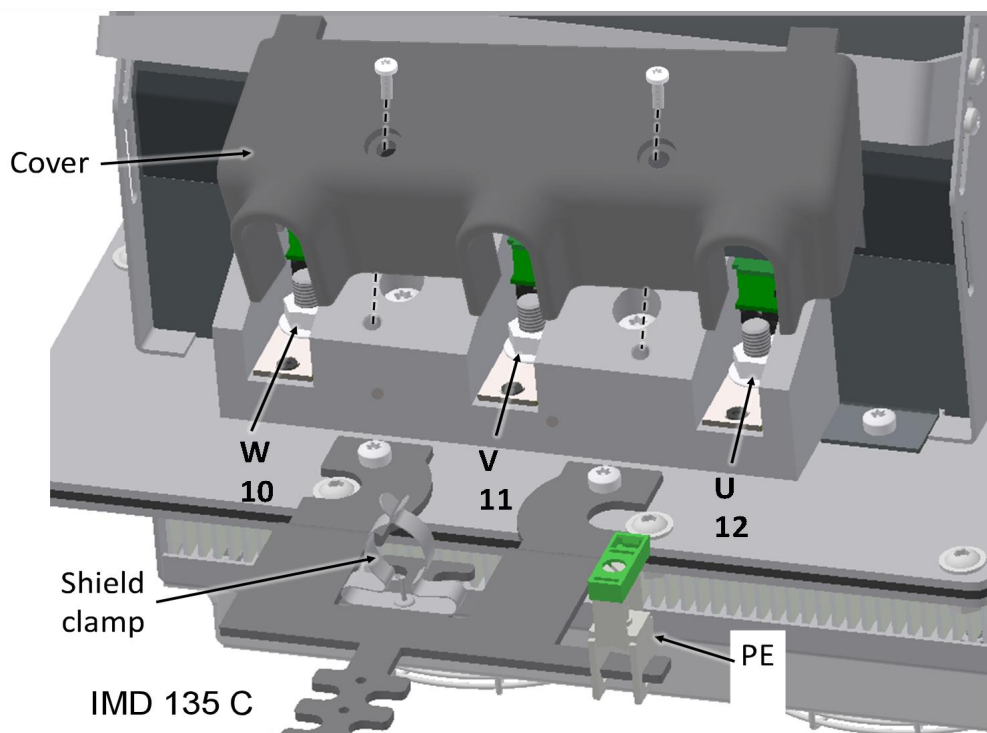
电机电缆的电线连接方式如下:




IMD 122 C



IMD 122 B and early production of IMD 122 C



IMD 135 C

Terminal no. 端子编号	Terminal text 端子文本	Description 说明
PE, 		Protective earth for motor output. The minimum size of the protective earth conductor must comply with local safety regulations for high protective earthing conductor current. 电机输出保护接地。保护接地导体的最小尺寸应符合当地高保护接地电流安全规范要求。
X1, Motor, 10 X1, 电机, 10	W	W motor output W 电机输出
X1, Motor 11 X1, 电机, 11	V	V motor output V 电机输出
X1, Motor, 12 X1, 电机, 12	U	U motor output U 电机输出

See *IMD 100 Installation instructions* for instructions about preparing the motor cable for connections, and how to use the connectors.

有关用于连接的电机电缆准备以及如何使用连接器的说明，请参阅《IMD 100 安装说明》。

5.2.2 Mains supply connections requirements 主电源连接要求

The mains connection is used to connect the IMD to the grid. The connection must have protective earthing. The IMD supports all earthing system types defined in BS 7671 (TN-S, TN-C-S, TT, TN-C, and IT).

主电源连接用于将 IMD 接入电网。连接必须有保护接地。IMD 支持 BS 7671 中定义的所有接地系统类型（TN-S、TN-C-S、TT、TN-C 和 IT）。



Attention 注意

The IMD must not be operated without connection to protective earthing. The mains supply must never exceed the range specified in the Data sheet. Risk of destruction of the IMD.

不得在未连接保护接地的情况下操作 IMD。主电源绝不能超过数据表中指定的范围。否则 IMD 有损坏的风险。

See *IMD 100 Datasheet* for mains input specifications.

Requirements for external components connected to the Mains input:

有关电源输入规格，请参阅《IMD 100 数据表》。

与电源输入相连的外部部件的要求：

EMC filters EMC 滤波器	Not needed *. Built-in EMC filter and input DC-link filter capacitors eliminates the need for external filters. Leakage current is less than 60mA. 不需要*。内置 EMC 滤波器和输入直流母线滤波器电容器无需外部滤波器。漏电流小于 60mA。
Main circuit breaker	Optional. 可选

主电路断路器	
Fuses 保险丝	Mandatory. Use maximum 32 A fuse type F, FF, or semiconductor automatic type D. 强制性的。使用最大 32 A 保险丝 F、FF 或半导体自动 D 型。

* In environment with very high electromagnetic interference or total harmonic disturbance it might be necessary to use an external EMC filter and/or line choke.

在电磁干扰或全谐波干扰非常高的环境中，可能需要使用外部 EMC 滤波器和/或线路扼流圈。

See [Table 2](#) on page [30](#) (PLH 16) for suitable wire cross section.

有关合适的导线横截面，请参见第 [30](#) 页的表 2（PLH 16）。

The protective earth wire is connected to X1, PE terminal.

保护接地线连接至 X1，PE 端子。

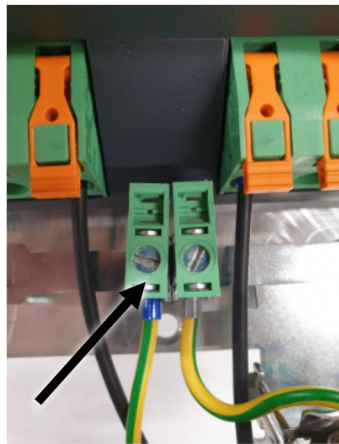
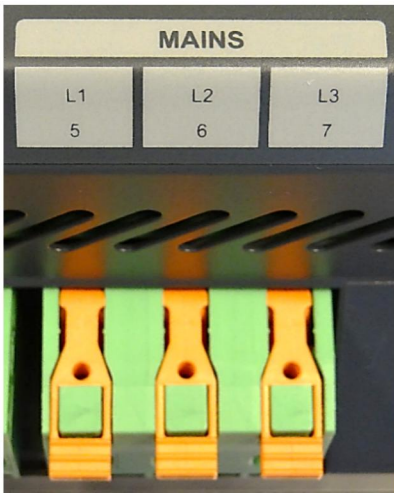
IMD 122 C and IMD 135 C: Phoenix AKG 16 GN flat blade screws terminal.

IMD 122 C 和 IMD 135 C: Phoenix AKG 16 GN 平刃螺丝端子。

IMD 122 B and early production of IMD 122 C: M5 threaded rod with nuts and washers. Suitable cable lugs for the used wires (not delivered) are needed for the connection.

IMD 122 B 和早期生产的 IMD 122 C: 带螺母和垫圈的 M5 螺纹杆。连接时需要与所用电线(未交付)配套的电缆接头。

The mains wires are connected as follows: 电源线的连接方式如下:

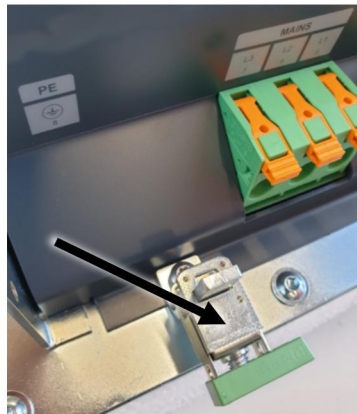


IMD 122 C



IMD 122 B and early production of IMD 122 C:

IMD 122 B 和早期生产的 IMD 122 C



IMD 135 C

Terminal no. 端子编号	Terminal text 端子文本	Description 说明
PE,		Protective earth from mains supply. The minimum size of the protective earth conductor must comply with local safety regulations for high protective earthing conductor current. 主电源的保护接地。保护接地导体的最小尺寸必须符合当地高保护接地导体电流的安全规定。
X1, Mains, 5 X1, 电源, 5	L1	L1 Mains power input L1 电源输入
X1, Mains, 6 X1, 电源, 6	L2	L2 Mains power input L2 电源输入
X1, Mains, 7 X1, 电源, 7	L3	L3 Mains power input L3 电源输入

The IMD is not sensitive to the order of the phases. IMD 对主电源的相序没有要求

See *IMD 100 Installation instructions* for instructions about how to use the connectors.

有关连接器的使用方法，请参阅《IMD 100 安装说明》。

5.2.3 Safe energy connection requirements 后备电源连接要求

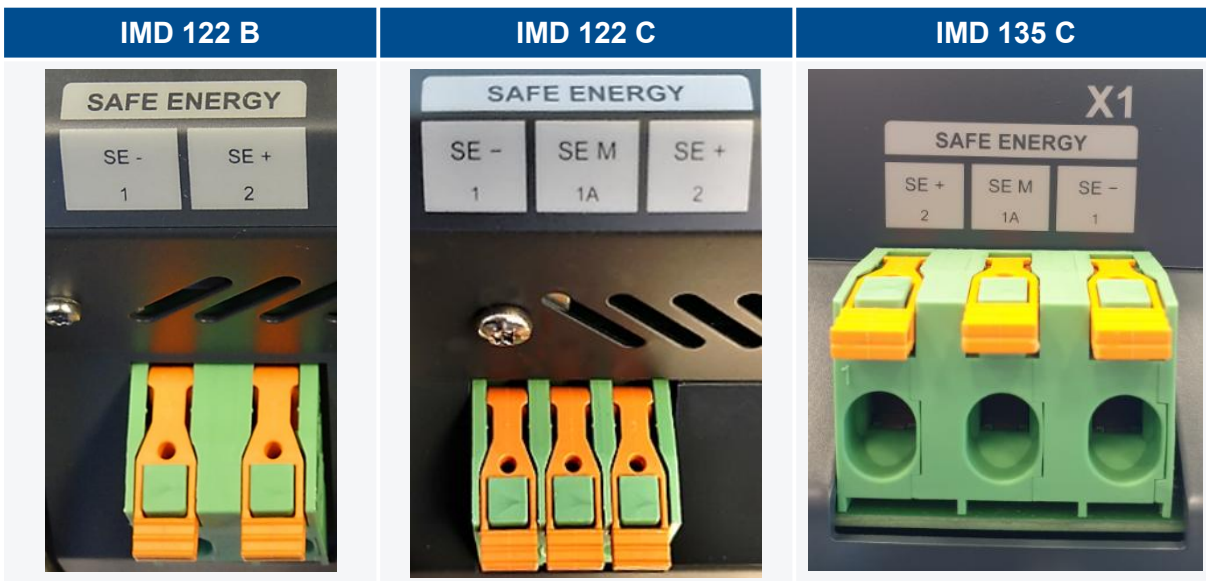
Safe energy source can be either batteries or ultra-caps. See *IMD 100 Datasheet* for Safe energy specifications. 后备电源可以是电池或超级电容。有关后备电源规范，请参见《IMD 100 数据表》。

Requirements for external components connected to the SE input:

与 SE 输入端相连的外部组件的要求：

Fuses 保险丝	Mandatory. Use maximum 50 A fuse type F, FF, or semiconductor automatic. 强制性。使用最大 50 A 的 F、FF 或半导体自动保险丝。
Voltage 电压	120 -500 V DC 120 -500 VDC

The safe energy wires are connected as follows: 后备电源线的连接方式如下：



Terminal no. 端子编号	Terminal text 端子文本	Description 说明
X1, SAFE ENERGY, 1 X1, 后备电源, 1	SE-	Safe energy negative terminal. 后备电源负极端子
X1, SAFE ENERGY, 1A X1 后备电源, 1A	SEM	Safe energy midpoint terminal (IMD 122 C, 135 C only). 后备电源中点端子（仅限 IMD 122 C 和 135 C）。
X1, SAFE ENERGY, 2 X1, 后备电源, 2	SE+	Safe energy positive terminal. 后备电源正极端子

See [Table 2](#) on page [30](#) (PLH 16) for suitable wire cross section.

有关合适的导线横截面，请参见第 [30](#) 页的表 2（PLH 16）。

See *IMD 100 Installation instructions* for instructions about how to use the connectors.

有关连接器的使用方法，请参阅 IMD 100 安装说明。

5.2.4 Ballast resistor requirements 制动电阻要求

IMD 122 B: The ballast resistor is built in the IMD fan house, and is already connected to the R-BALLAST terminals upon delivery. The ballast resistor is a 20 Ω 300 W resistor (in total). The resistor is dimensioned for the motors which the IMD is designed to control.

It is however possible to use other resistors instead of the built-in resistor by disconnecting the resistor's wires from the R-BALLAST connectors and connecting the new resistors wires instead.

IMD 122 C: The IMD 122 C does not have built in ballast resistor as standard. It is possible to order the IMD with the "Internal ballast" option, in which case, the ballast resistor terminals are not available.

IMD 135: The IMD 122 C does not have built in ballast resistor as standard. A ballast resistor cannot be ordered with the IMD.

IMD 122 B: 制动电阻内置在 IMD 风扇罩中，并且在交付时已经连接到内部制动电阻接线端子。制动电阻是一个 20 Ω 300 W 电阻器（总计）。电阻器的尺寸适用于 IMD 控制的电机。

但是，通过从内部制动电阻接线端子上断开电阻器导线并连接新电阻器导线，可以使用其他电阻器代替内置电阻器。

IMD 122 C: IMD 122 C 没有标准内置制动电阻。可以订购带有“内部镇流器”选项的 IMD，在这种情况下，制动电阻端子不可用。

IMD 135: IMD 122 C 没有标准内置制动电阻。不能与 IMD 一起订购制动电阻。



Attention 注意

Dimensioning and implementing another ballast resistor must only be done by experts. The minimum ballast resistor value must ensure that the current to the resistor does not exceed the specification in the IMD 100 Datasheet. The current also depends on the configured DC-link maximum value (see section [8.4.1](#) on page [105](#) for details).

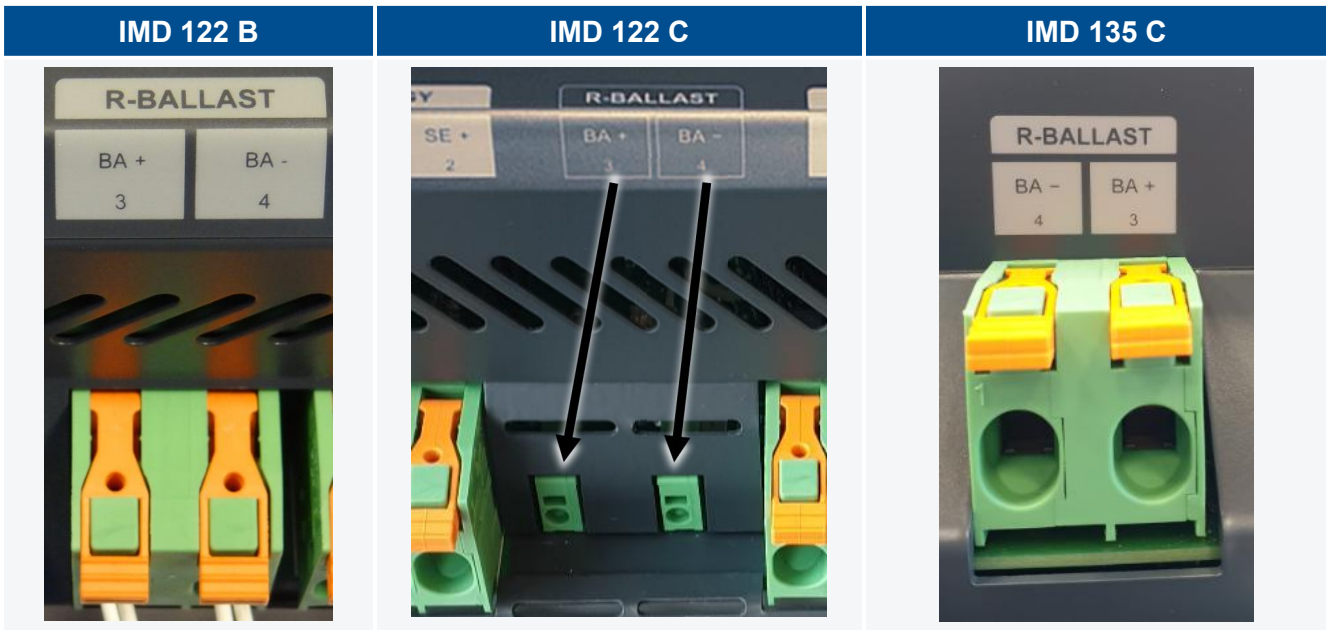
另一个制动电阻的尺寸设计和安装必须由专家完成。制动电阻的最小值必须确保电阻器的电流不超过 IMD 100 数据表中的规格。电流还取决于配置的母线电压最大值（详见第 [105](#) 页第 8.4.1 节）。

Absolute minimum resistor values:绝对最小电阻值:

- IMD 122 B/C: 12 Ω
- IMD 135 C: 10 Ω

The ballast resistor wires are connected as follows:

制动电阻导线的接线方式如下：



Terminal no. 端子编号	Terminal text 端子文本	Description 说明
X1, R-BALLAST, 3 X1, 制动电阻, 3	BA +	Positive terminal for the ballast resistor 制动电阻的正极端子
X1, R-BALLAST, 4 X1, R-镇流器, 4	BA -	Negative terminal for the ballast resistor 制动电阻的负极端子

See [Table 2](#) on page [30](#) (PLH 16, SPT 2.5) for suitable wire cross section.

请参阅第 [30](#) 页的表 2 (PLH 16, SPT 2.5) 以获得合适的导线横截面。

5.3 Peripheral and temperature connections (X2, X3, X4, X5)

外围线路和温度连接(X2, X3, X4, X5)

Connecting the peripheral motor connections depends on the actual motor used. The temperature sensor(s) connections may come with their own separate cables, as part of the resolver cable, or inside the motor cable.

连接外围电机的方式取决于实际使用的电机。温度传感器连接可能自带单独的电缆，作为编码器电缆的一部分，或在电机电缆内部。

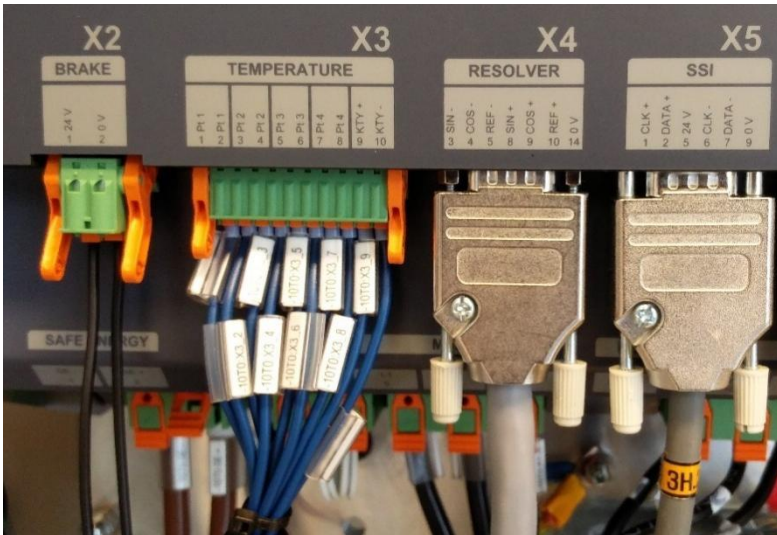


Figure 21 X2, X3, X4, and X5 connections

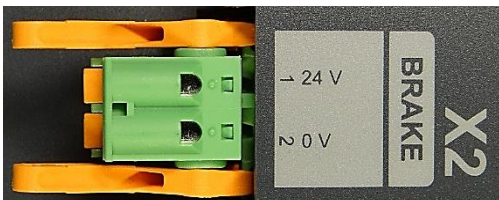
图 21 X2、X3、X4 和 X5 连接

5.3.1 Connecting the motor brake (X2) 连接电机制动器 (X2)

The brake is an integral part of the motor. See requirements for the brake [Table 3](#) on page [35](#). The brake wires are typically part of the motor cable. They are connected to X2, see constraints on wire cross section in [Table 2](#) on page [30](#) (FK-MCP 2.5).

制动器是电机的一个组成部分。请参阅第 [35](#) 页上的表 3 对制动器的要求。制动器导线通常是电机电缆的一部分，连接到 X2，请参阅第 26 页的表 2 中的导线横截面限制 (FK-MCP 2.5)。

The brake wires are connected as follows:制动导线的连接方式如下：



Terminal no. 端子编号	Terminal text 端子文本	Description 说明
X2, BRAKE, 1 X2, 制动器, 1	24 V	Positive terminal for the brake 制动器的正极端子
X2, BRAKE, 2 X2, 制动器, 2	0 V	Negative terminal for the brake 制动器的负极端子

5.3.1.1 Motor brake requirements 电机制动器要求

Brake voltage 制动电压	24 V DC
Maximum brake current 最大制动电流	5 A DC

Maximum allowed current to the brake is 5 A DC. 制动器的最大允许电流为 5 A DC。

5.3.2 Connecting the temperature sensors (X3, optional) 连接温度传感器 (X3, 可选)

If the motor temperature sensor wires are not in the resolver cable, the sensor is connected to X3. (Never connect the same sensor to both X3 and X4 connectors.) If Pt100 is used as motor sensor, it must be connected to Pt 4, and Pt 4 is then configured as motor temperature sensor (KTY 84 is the default motor temperature sensor (see section 8.4.2 on page 115)). When Pt 4 is not configured as Motor temperature sensor, it can be used in the same way as the other three Pt 100 sensor inputs.

如果电机温度传感器导线不在编码器电缆中，则将传感器连接到 X3(切勿将同一传感器同时连接到 X3 和 X4 连接器。) 如果使用 Pt100 作为电机传感器，则必须将其连接到 Pt 4，然后将 Pt 4 配置为电机温度传感器 (KTY 84 是默认的电机温度传感器 (见第 88 页第 8.4.2 节))。当未配置 Pt 4 为电机温度传感器时，其使用方式与其他三个 Pt 100 传感器输入相同。

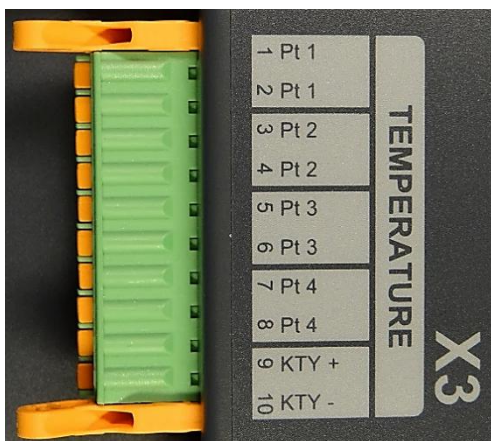


Info 信息

PTC sensor can be used instead of KTY sensor.

可使用 PTC 传感器代替 KTY 传感器。

If X3 is used, the motor temperature sensors wires are connected as follows: 如果使用 X3，电机温度传感器导线的连接方式如下：



Terminal no. 端子编号	Terminal text 端子文本	Description 说明
X3, 1	Pt 1	First terminal for Pt 1 (Pt100) temperature sensor. NOTE If a built-in charger is used with temperature compensation, Pt 1 terminals must be used for the sensor. Pt 1 (Pt100) 温度传感器的第一个端子。 注：如果内置充电器与温度补偿一起使用，则传感器必须使用 Pt 1 端子。
X3, 2	Pt 1	Second terminal for Pt 1 (Pt100) temperature sensor. NOTE If a built-in charger is used with temperature compensation, Pt 1 terminals must be used for the sensor.

Terminal no. 端子编号	Terminal text 端子文本	Description 说明
		Pt 1 (Pt100) 温度传感器的第二个端子。 注：如果内置充电器与温度补偿一起使用，则传感器必须使用 Pt 1 端子。
X3, 3	Pt 2	First terminal for Pt 2 (Pt100) temperature sensor Pt 2 (Pt100) 温度传感器的第一个端子
X3, 4	Pt 2	Second terminal for Pt 2 (Pt100) temperature sensor Pt 2 (Pt100) 温度传感器的第二个端子
X3, 5	Pt 3	First terminal for Pt 3 (Pt100) temperature sensor Pt 3 (Pt100) 温度传感器的第一个端子
X3, 6	Pt 3	Second terminal for Pt 3 (Pt100) temperature sensor Pt 3 (Pt100) 温度传感器的第二个端子
X3, 7	Pt 4	First terminal for the Pt100 motor temperature sensor Pt100 电机温度传感器的第一个端子
X3, 8	Pt 4	Second terminal for the Pt100 motor temperature sensor Pt100 电机温度传感器的第二个端子
X3, 9	KTY +	Positive terminal for the KTY 84 or PTC sensor KTY 84 或 PTC 传感器的正极端子
X3, 10	KTY -	negative terminal for the KTY 84 or PTC sensor KTY 84 或 PTC 传感器的负极端子

See wire cross section constraints in [Table 2](#) on page [30](#) (FK-MCP 1.5). 见第 [30](#) 页表 2 中的导线横截面约束 (FK-MCP 1.5)。



Info

The accuracy of the temperature measurements might be impacted if the temperature sensor's wires are long. See accuracy specification in the *IMD 100 Datasheet*.

信息

如果温度传感器的导线较长，可能会影响温度测量的准确性。参阅《IMD 100 数据表》中的精度规范。

5.3.3 Connecting the resolver (X4) 连接编码器 (X4)

The resolver is a measuring system for a motor revolution. It is robust and insensitive to high temperature. The architecture of a resolver corresponds to a rotating transformer. The IMD is compatible with most industrial resolvers.

编码器是一种电机转速测量系统。它坚固耐用，对高温不敏感。编码器的结构相当于一个旋转的变压器。IMD 与大多数工业编码器兼容。

The rotor is powered by the reference. The stator provides the modulated frequency of the rotary-sine and cosine signals. The amplitudes of these signals are digitized and evaluated in the servo amplifier.
 转子由基准电压驱动。定子提供旋转正弦和余弦信号的调制频率。这些信号的振幅在伺服放大器中进行数字化和评估。

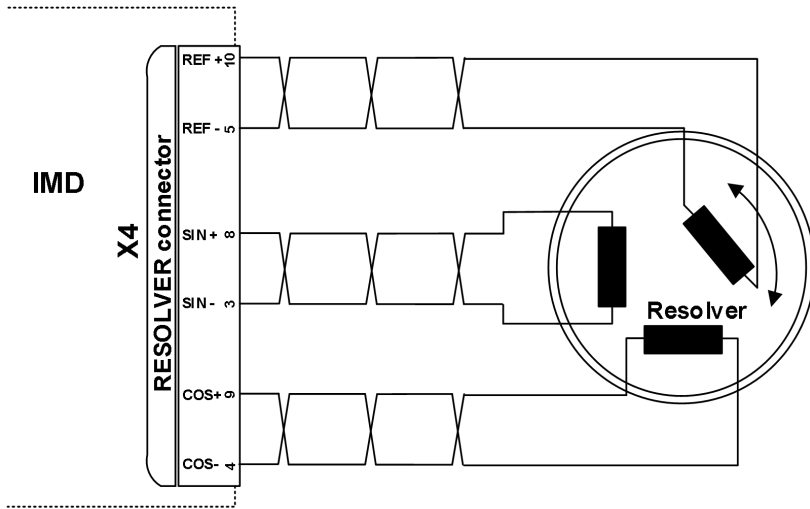


Figure 22 Resolver architecture and connections 图 22 编码器架构和连接

The digitized signals are used for position and speed control. 数字信号用于位置控制和速度控制。

Pt4 and KTY motor temperature sensors can be connected to the IMD through either X3 or X4. Never connect the same sensor to both connectors

Pt4 和 KTY 电机温度传感器可以通过 X3 或 X4 连接到 IMD。切勿将同样的传感器同时连接到这两个端子

The resolver wires are connected to a male 15 pole D-sub connector as follows:

编码器电线连接到公 15 针 D-sub 连接器，如下所示：



Terminal no. 端子编号	Terminal text 端子文本	Description 说明
1, 2, 13, 15		Not connected 未连接
3	(s3) SIN-	Sine signal Low 正弦信号低
4	(s4) COS-	Cosine signal Low 余弦信号低
5	(r2) REF-	Exciter ref voltage Low 励磁机参考电压低
6	PT 4 - 1	PT 100 temp. sensor 4 - 1 (Motor)Pt100 温度传感器 4 -

Terminal no. 端子编号	Terminal text 端子文本	Description 说明
		1(电机)
7	KTY +	KTY temp. sensor + (Motor)KTY 温度传感器+(电机)
8	(s1) SIN+	Sine signal High 正弦信号高
9	(s2) COS+	Cosine signal High 余弦信号高
10	(r1) REF+	Exciter ref voltage High 励磁机参考电压高
11	PT 4 - 2	PT 100 temp. sensor 4 - 2 (Motor)Pt100 温度传感器 4 - 2(电机)
12	KTY -	KTY temp. sensor - (Motor)KTY 温度传感器-(电机)
14	0 V	Reference potential 参考电位

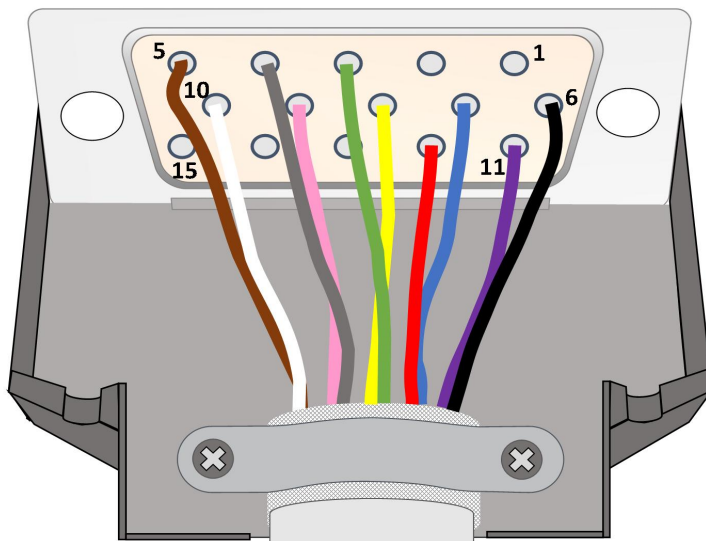


Figure 23 Resolver D-sub connection

图 23 编码器 D-sub 连接



Info 信息

Colour coding may differ depending on the cable used.
The depicted connections are shown with both KTY 84 and Pt100 sensors connected.
编码器线缆颜色可能因使用的电缆不同而有差异。
图中所示为 KTY 84 和 Pt100 传感器均已连接的情况下的连接示意图。

Shields must be connected to the housing of both connectors (D-sub and the connector to the resolver) as depicted in the following figure:屏蔽必须连接到两个接头 (D-sub 和编码器接头) 的外壳上, 如下图所示:

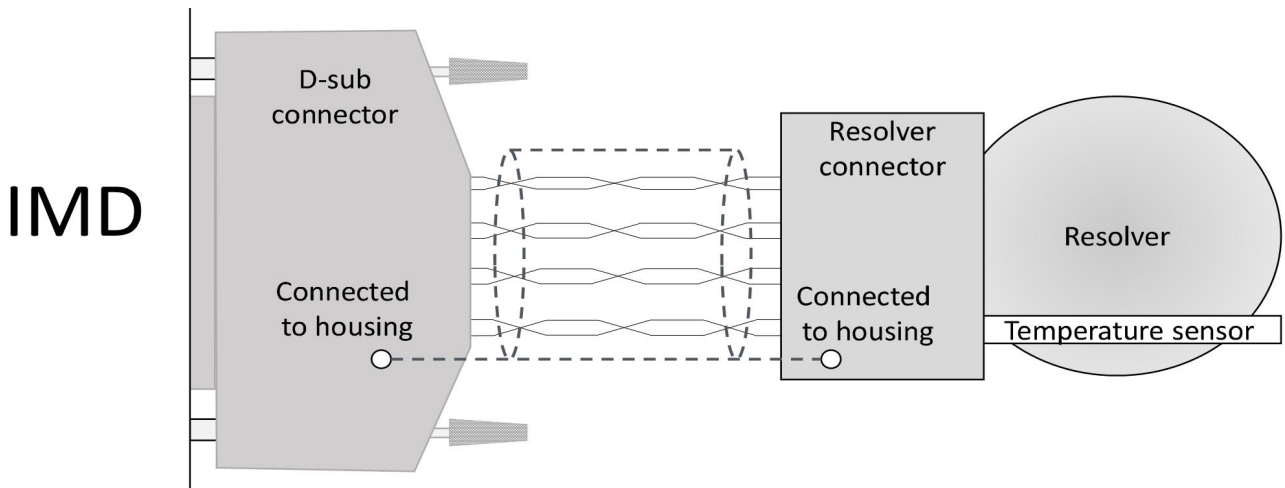


Figure 24 Shield connection 图 24 屏蔽连接

5.3.3.1 Cable requirement 电缆要求

Use only shielded resolver cables with twisted pairs. 仅使用带双绞线的屏蔽编码器电缆。

5.3.3.2 Connector housing requirements 连接器外壳要求

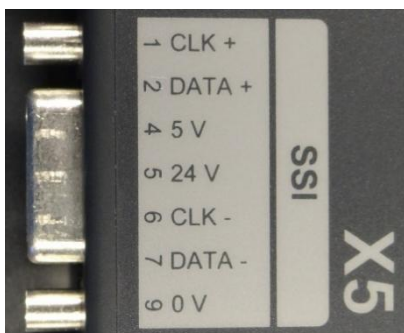
Use metal or metalized 9 pole male D-sub housing. All shields must be connected to the connector housing. 使用金属或金属化 9 针公 D-sub 外壳。所有屏蔽必须连接到连接器外壳。

5.3.4 Connecting the SSI (X5), optional 连接 SSI (X5) , 可选

The Synchronous Serial Interface (SSI) sensor is an optional component. It is typically used by the application SW to determine the position of the blade. It is never used by the IMD for actual control, though the SSI value can be read by an extern pitch motion controller, main controller, or the IMD Manager.

同步串行接口（SSI）传感器是可选组件。应用软件通常使用它来确定叶片的位置。虽然 SSI 值可由变桨控制器、主控制器或 IMD 监控软件读取，但 IMD 从未将其用于实际控制。

The SSI wires are connected to a female 9 pole D-sub connector as follows: SSI 线连接到母 9 针 D-sub 连接器，如下图所示：



Terminal no. 端子编号	Terminal text 端子文本	Description 说明
1	CLK +	Output clock positive signal 输出时钟正信号
2	DATA +	Input data channel positive signal 输入数据通道正信号

Terminal no. 端子编号	Terminal text 端子文本	Description 说明
3, 8		Not connected 未连接
4	5 V	+5 V DC+5VDC
5	24 V	+24 V DC+24VDC
6	CLK -	Output clock (negative)输出时钟（负）
7	DATA -	Input data channel (negative)输入数据通道（负）
9	0 V	Reference potential 参考电位

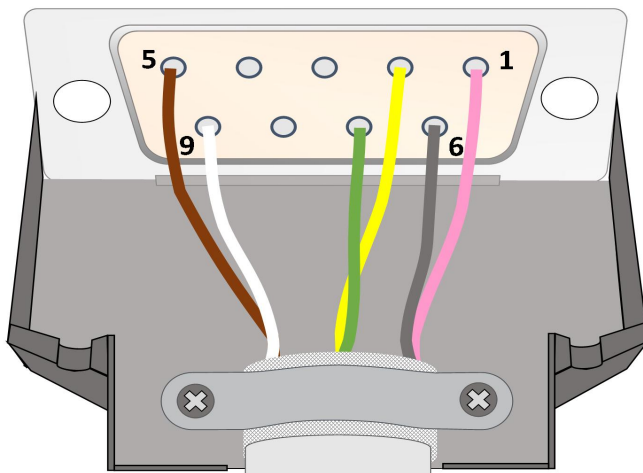


Figure 25 SSI encoder D-sub connection 图 25 SSI 编码器 D-sub 连接



Info 信息

Colour coding may differ depending on the cable used.

The depicted connection is for a 24 V DC SSI encoder.

Read the encoder's manual to determine if the direction input needs to be terminated.

颜色编码可能因使用的电缆而异。

所示连接适用于 24 V DC SSI 编码器。

阅读编码器手册，以确定是否需要终止方向输入。

Shields must be connected to the housing of both connectors (D-sub and the connector to the encoder) as depicted in the following figure:屏蔽必须连接到两个连接器的外壳(D-sub 和编码器的连接器), 如下图所示:

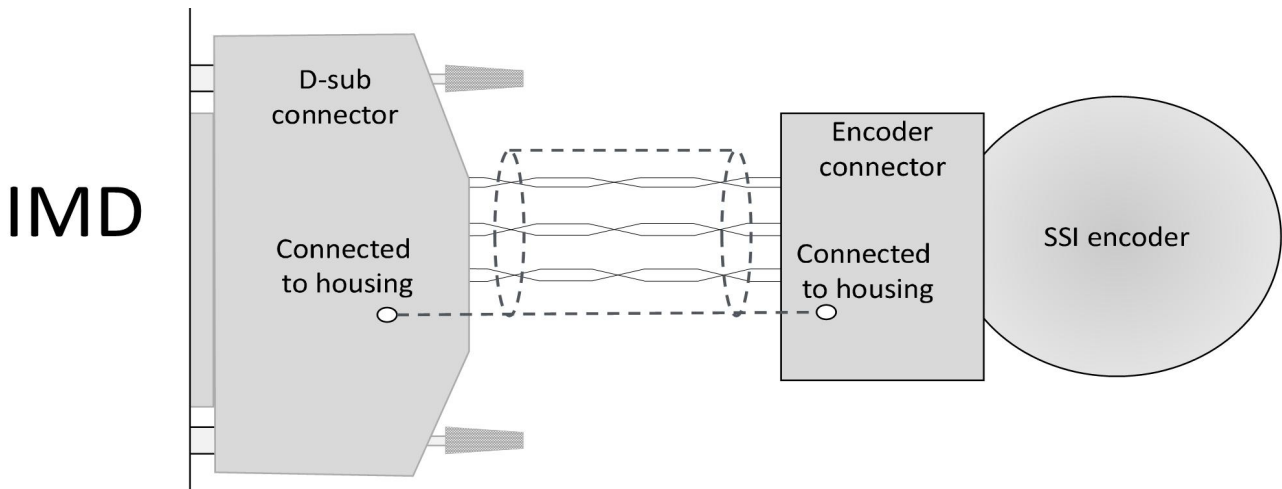


Figure 26 Shield requirement to SSI cable with temperature sensor 图 26 带温度传感器的 SSI 电缆屏蔽要求



Info

Some SSI encoders have no connector and the cable is already connected to the encoder from the factory.

信息

某些 SSI 编码器没有连接器, 并且电缆在出厂时已连接到编码器。

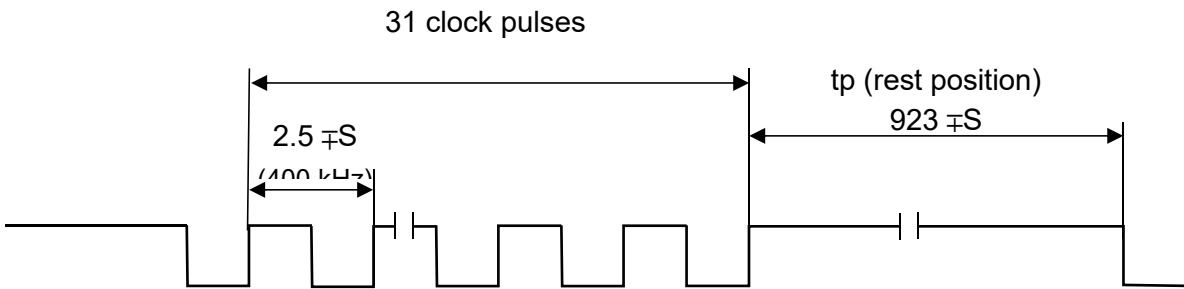
5.3.4.1 SSI encoder requirements SSI 编码器要求

Only absolute encoder with some specific data formats is supported. The SSI encoder must comply with the following requirements:仅支持具有某些特定数据格式的绝对编码器。SSI 编码器必须符合以下要求:

	Unit 单位	Specifications 规格	Note 注释
SSI Encoder type SSI 编码器类型	N/A	Absolute encoder, single-turn, or multi-turn 绝对式编码器, 单圈或多圈	Incremental encoder is not supported 不支持增量编码器
SSI encoder supply voltage SSI 编码器电源电压	V DC 直流电压	5 或 24	
SSI encoder current SSI 编码器电流	A DC 直流电	24 V DC: Max. 0.2 5 V DC: Max 0.5 24VDC: 最大 0.2 伏 5VDC: 最大 0.5 伏	Internal thermal fuse in IMD IMD 内部热保险丝
SSI encoder interface differential input / output	V DC 直流	Complies with RS485 符合 RS485	(IMD input impedance is 150 Ω)

	Unit 单位	Specifications 规格	Note 注释
SSI 编码器接口差分输入/输出	电压		(IMD 输入阻抗为 150Ω)
SSI encoder resolution SSI 编码器分辨率	Bits 位	Single-turn: 12+1 单圈 Multi-turn: 12+12(+1) 多圈	Single turn: 12 bit resolution per revolution + special bit Multi-turn: 12 bit resolution per one revolution + 12 bits for number of turns + special bit (special bit is optional) 单圈：每圈 12 位分辨率+特殊位 多圈：每圈 12 位分辨率+12 位圈数+特殊位（特殊位可选）
SSI encoder output format SSI 编码器输出格式	N/A	Single-turn: Binary Multi-turn: Gray code 单圈：二进制 多圈：格雷码	
SSI encoder clock frequency SSI 编码器时钟频率	kHz	The top of the clock frequency range must be higher than 500 Hz 时钟频率范围的最大值必须高于 500Hz	(the IMD clock frequency is approximately 400 kHz) (IMD 时钟频率约为 400kHz)

The clock pulses sent from the IMD are according to the following:IMD 发送的时钟脉冲如下所示：



Info 信息

After sending the LSB (multi-turn) or special bit (single-turn), the encoder sends a zero. This zero is used to determine whether the SSI input is OK (status in Reg. 0x9B, bit 31). If a wrong type encoder is configured, the SSI input indication will be mainly off, but at some positions it might be on.

在发送 LSB(多圈)或特殊位(单圈)后，编码器发送一个零。这个零用于确定 SSI 输入是否正常（状态为 Reg. 0x9B，第 31 位）。如果配置了错误的编码器类型，SSI 输入指示将主要是关闭的，但在某些位置可能会打开。

5.3.4.2 Cable requirements 电缆要求

Use only shielded encoder cables with twisted pairs.

仅使用带有双绞线的屏蔽编码器电缆。

5.3.4.3 Connector housing requirements 连接器外壳要求

Use metal or metalized 9 pole male D-sub housing. All shields must be connected to the connector housing. 使用金属或金属化 9 针公 D-sub 外壳。所有屏蔽必须连接到连接器外壳上。

5.4 Communication 通信

5.4.1 Connecting the CAN bus (X6) 连接 CAN 总线(X6)

A CAN network must be terminated with 120 Ω at both ends. If there are no input/output connectors in each unit, the CAN bus can also be implemented as an open ring. [Figure 28](#) on page [55](#) illustrates a typical implementation of three IMDs in a hub. Note that CAN low is always connected to CAN low and CAN high is always connected to CAN high. Termination resistors are only used in IMD 3 by connecting pin 2 to pin 4, and pin 7 to pin 8 (it is assumed that the pitch motion controller or main controller is terminated as well).

CAN 总线两端必须为 120 Ω 电阻。如果在每个单元中没有输入/输出连接器，也可以将 CAN 总线实施为一个开环。第 45 页的图 28 说明了集线器中三个 IMD 的典型实施方式。请注意，CAN 低始终连接到 CAN 低，而 CAN 高始终连接到 CAN 高。终端电阻仅用于 IMD 3，通过将引脚 2 连接到引脚 4，将引脚 7 连接到引脚 8（假设变桨控制器或主控制器也连接终端电阻）。

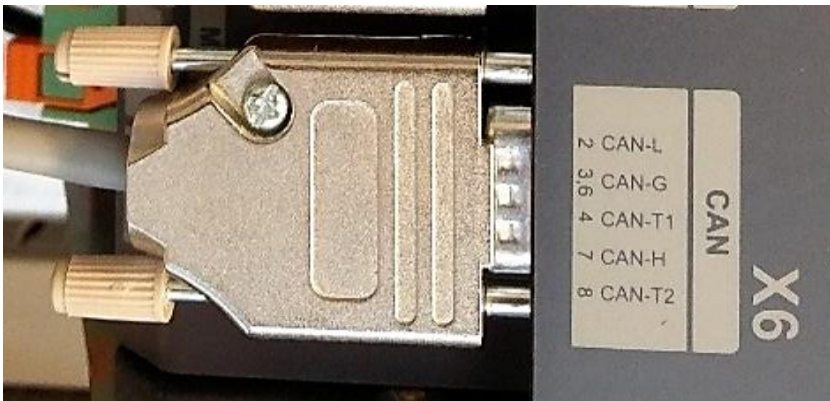


Figure 27 X6 connection 图 27 x6 连接

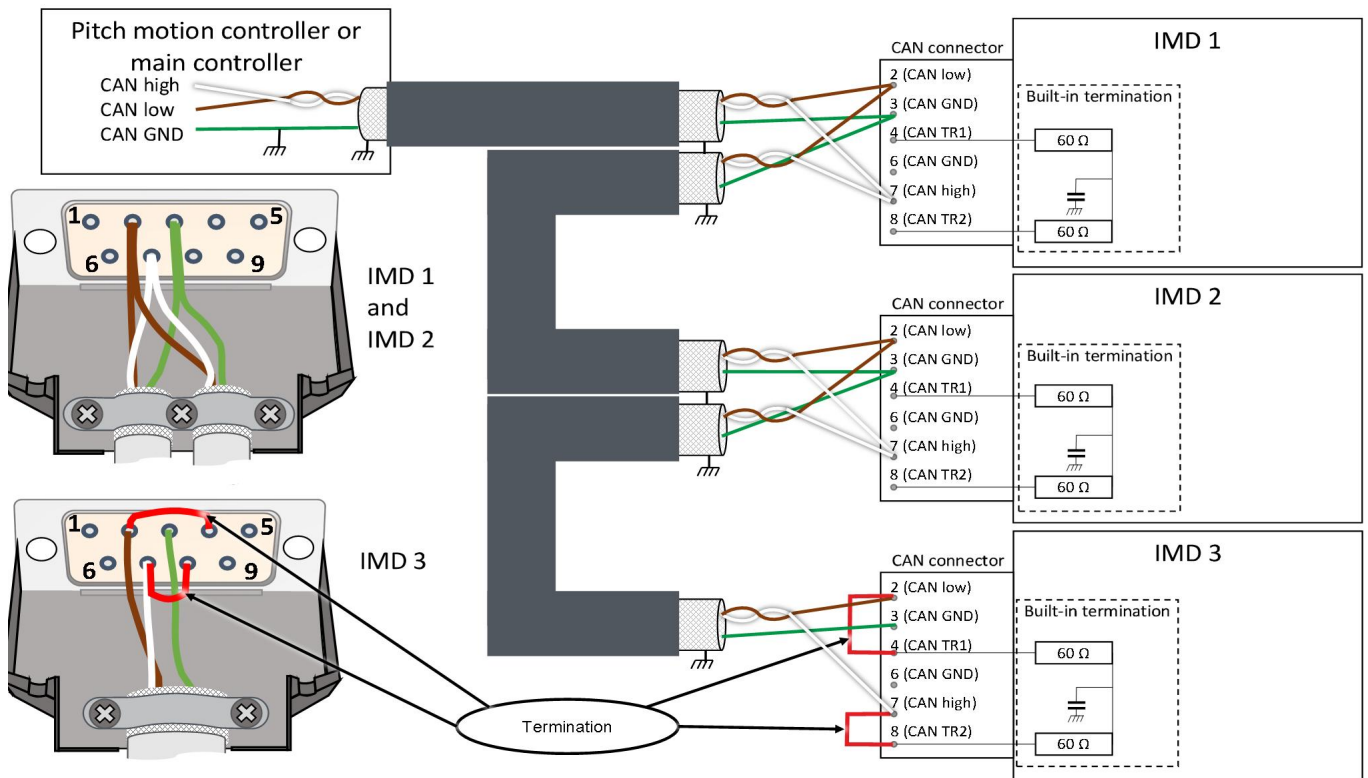


Figure 28 CAN connections

图 28 CAN 连接

Attention

Shields must be connected to the D-sub connector housing (see section 5.4.1.1 on page 56 and section 5.4.1.2 on page 57) unless they carry the CAN GND. See also general shielding and lightning protection in section 5.1 on page 31.

The CAN GND must be connected in one, and one place only to PE.



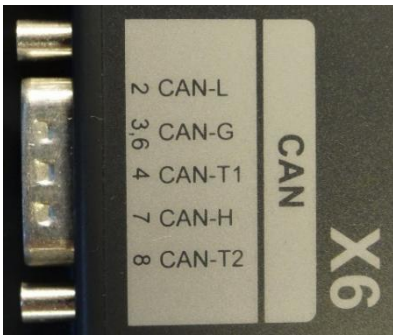
注意

屏蔽必须连接到 D-sub 连接器外壳(参见第 46 页的 5.4.1.1 节和第 46 页的 5.4.1.2 节), 除非它们带有 CAN GND。请参阅第 27 页第 5.1 节的通用屏蔽和防雷。

CAN GND 必须在一个位置连接, 并且只能在一个位置连接到 PE。

The CAN wires are connected to a male 9 pole D-sub connector as follows:

CAN 导线连接到公 9 针 D-sub 连接器，如下所示：



Terminal no. 端子编号	Terminal text 端子文本	Description 说明
1,9		Not connected 未连接
2	CAN-L	CAN low CAN 低
3, 6	CAN-G	CAN GND
4	CAN-T1	CAN termination resistor T1 CAN 终端电阻 T1
5	-	Optional shielding terminal containing the following circuit inside the IMD: 可选屏蔽端子 IMD 内部包含以下电路： <div style="text-align: right;"> </div>
7	CAN-H	CAN 高
8	CAN-T2	CAN termination resistor T2 CAN 终端电阻 T2

5.4.1.1 Cable requirement 电缆要求

It is required that shielded cables with twisted pairs are used for the CAN connections. Cables designed for CAN bus communication according to ISO 11898 are recommended. Two pairs or one cord and a twisted pair must be used. CAN H and CAN L must always be a twisted pair. See also section 5.1 on page 31.

CAN 连接要求使用双绞线屏蔽电缆。推荐采用符合 ISO 11898 标准的 CAN 总线通信电缆。必须使用两对或一根线和一对双绞线。CAN H 和 CAN L 必须始终是双绞线。另见第 27 页第 5.1 节。

Info 信息



In some cases, it is possible to use the CAN connections without common ground, and thus use a shielded 2 wire cable for units in different cabinets. However, without common GND the communication might get unstable, and it is not possible to predict beforehand whether it will happen or not. DEIF recommends to use cables that have either an extra twisted pair or an extra inner shield in order to be able to connect the common GND between the units.

在某些情况下，可以使用不带公共接地的 CAN 连接，从而在不同机柜的装置使用屏蔽的 2 线电缆。但是，如果没有共同的 GND，通信可能会变得不稳定，也不可能事先预测它是否会发生。DEIF 建议使用具有额外双绞线或额外内屏蔽的电缆，以便能够连接单元之间的公共 GND。

5.4.1.2 Connector housing requirements 连接器外壳要求

Use metal or metalized 9 pole female D-sub housing. All shields must be connected to the connector housing.

使用金属或金属化 9 针母 D-sub 外壳。所有屏蔽必须连接到连接器外壳上。

5.5 Connecting 24V, digital and safety I/O (X7, X8, X9) 连接 24V、数字和安全 I/O (X7、X8、X9)

X7, X8, and X9 are implemented as a male-female connector with the male part on the IMD and the wires are connected to the female part. All female parts are delivered with the IMD.

X7、X8 和 X9 实现为公母连接器，公零件位于 IMD 上，导线连接到母零件。所有内螺纹零件均随 IMD 一起交付。

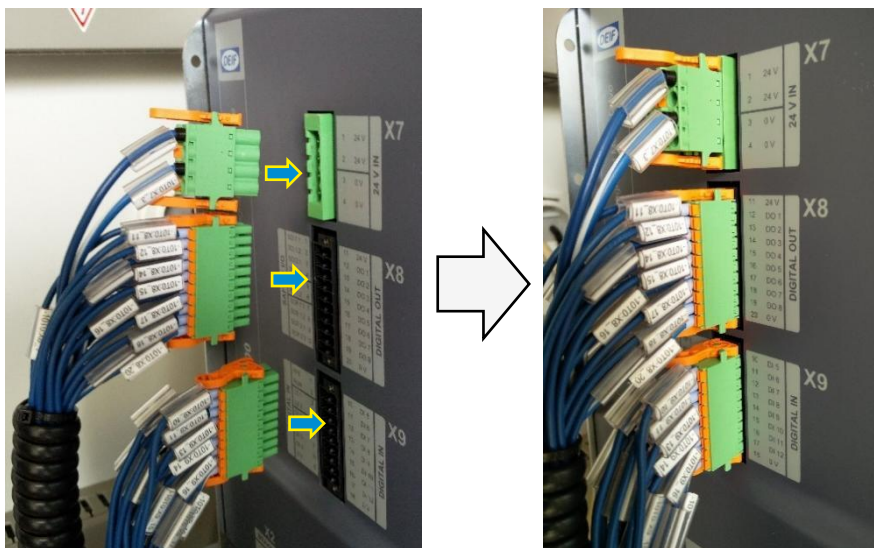


Figure 29 Male-female connectors 图 29 公母连接器

See detailed description of how to connect wires to the female connector and how to connect/disconnect the female to the male connectors in the *IMD 100 Installation instructions*.

See detailed description of the functions of the connections in the IMD function description.

请参阅 IMD 100 安装说明中有关如何将电线连接到母连接器以及如何将母连接器连接/断开连接到公连接器的详细说明。

连接功能的详细描述见 IMD 功能概要。

5.5.1 Connecting digital inputs (X9) 连接数字输入 (X9)

All inputs in X9 have the following HW specifications:

X9 的所有输入均有以下 HW 规格:

Voltage range 电压范围	0 – 36 V 直流电
Digital low 数字低状态	0 – 5 V 直流电
Digital high 数字高状态	9 – 36 V 直流电
Impedance 阻抗	Approximately 2.4 kΩ 大约 2.4 kΩ
Input current (high)输入电流 (高)	Approximately 7.3 mA @ 24 V 直流电 大约 7.3 mA @ 24 V 直流电



Info 信息

To calculate the approximated input current at a specific voltage: $I = (U - 6)/2460$
 计算特定电压下的近似输入电流: $I = (U - 6)/2460$

Typical implementation of circuit for digital input: 数字输入电路的典型实现:

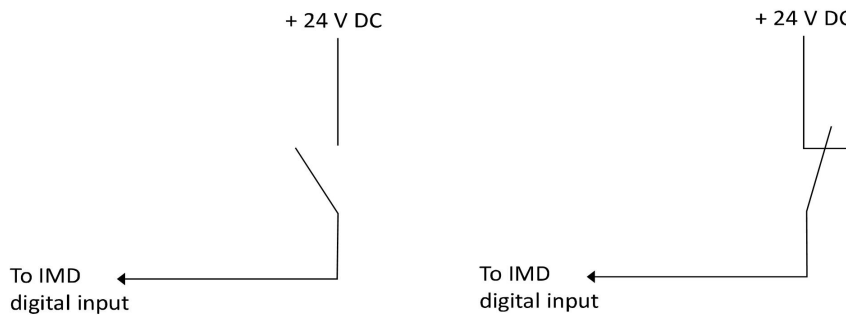
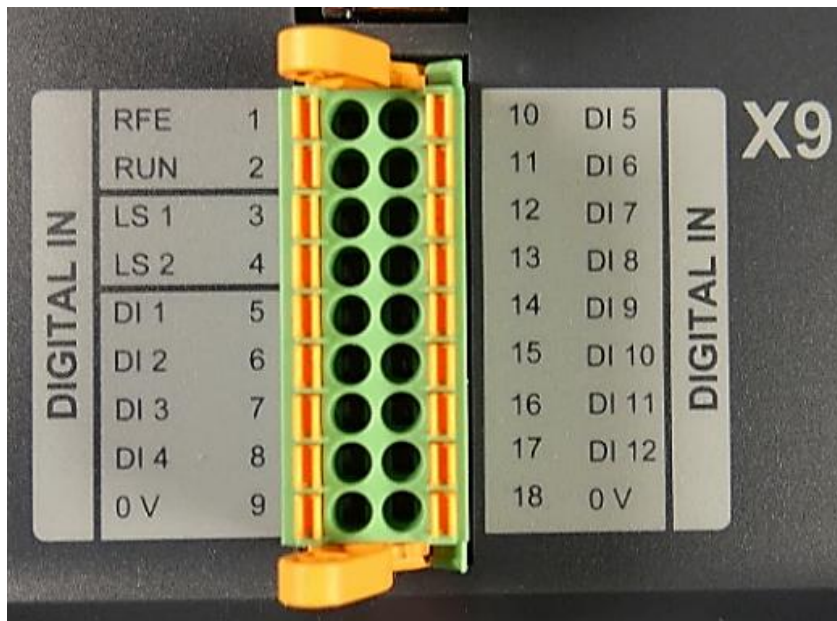


Figure 30 Typical digital input interfaces

图 30 典型数字输入接口

The digital input wires are connected to the female connector as follows:

数字输入线与母连接器的连接方式如下:



Terminal no. 端子编号	Terminal text 端子文本	Description 说明
1	RFE	Rotational Field Enable, intended to be used as safe torque off for emergency stop buttons. Disables the power module and engages the brake. Use a normally closed switch connected to +24 V DC. 旋转磁场启用，旨在用作紧急停止按钮的安全扭矩关闭。禁用电源模块并抱闸。使用常闭开关连接到+ 24v DC。
2	RUN	Device enable. If in motion, the motor actively decelerates and brake sequence started. If not in motion the device is disabled and the motor brake is engaged. 设备启用。如果处于运动状态，电机将主动减速并启动抱闸程序。如果未处于运动状态，则禁用该设备，并抱闸。
3	LS 1	Limit switch 1 (active high or low is configurable) 限位开关 1（激活高状态或低状态可配置）
4	LS 2	Limit switch 2 (active high or low is configurable) 限位开关 2（激活高状态或低状态可配置）
5	DI 1	Digital input 1 数字输入 1
6	DI 2	Digital input 2 数字输入 2
7	DI 3	Digital input 3 数字输入 3
8	DI 4	Digital input 4 数字输入 4
9	0 V	Ground 接地
10	DI 5	Digital input 5 数字输入 5
11	DI 6	Digital input 6 数字输入 6

Terminal no. 端子编号	Terminal text 端子文本	Description 说明
12	DI 7	Digital input 7 数字输入 7
13	DI 8	Digital input 8 数字输入 8
14	DI 9	Digital input 9, (reserved for manual operation 360 “360 enabled” if manual operation 360 is enabled in the configuration)数字输入 9, (如果配置中启用了手动操作 360, 则保留手动操作 360 “360 启用”)
15	DI 10	Digital input 10, (reserved for manual operation “-” [CCW] if manual operation is enabled in the configuration)数字输入 10, (如果在配置中启用了手动操作, 则保留手动操作 “-” [CCW])
16	DI 11	Digital input 11, (reserved for manual operation “+” [CW] if manual operation is enabled configuration)数字输入 11, (如果在配置中启用了手动操作, 则保留手动操作 “+” [CW])
17	DI 12	Digital input 12, (reserved for manual operation “Manual enable” if manual operation is enabled configuration)数字输入 12, (如果在配置中启用了手动操作, 则保留手动操作 “手动启用”)
18	0 V	Ground 接地



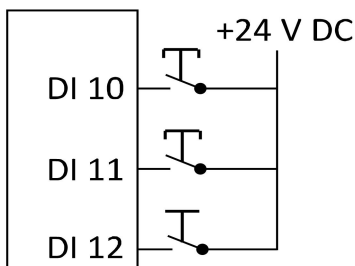
Attention

The digital inputs are galvanically isolated from the IMD circuit by optocouplers. Ground from the external circuit must be connected to terminal 18.

注意

数字输入通过光电耦合器与 IMD 电路进行电流隔离。外部电路的接地必须连接到端子 18。

Recommended connections for manual operation: 手动操作的推荐连接方式:



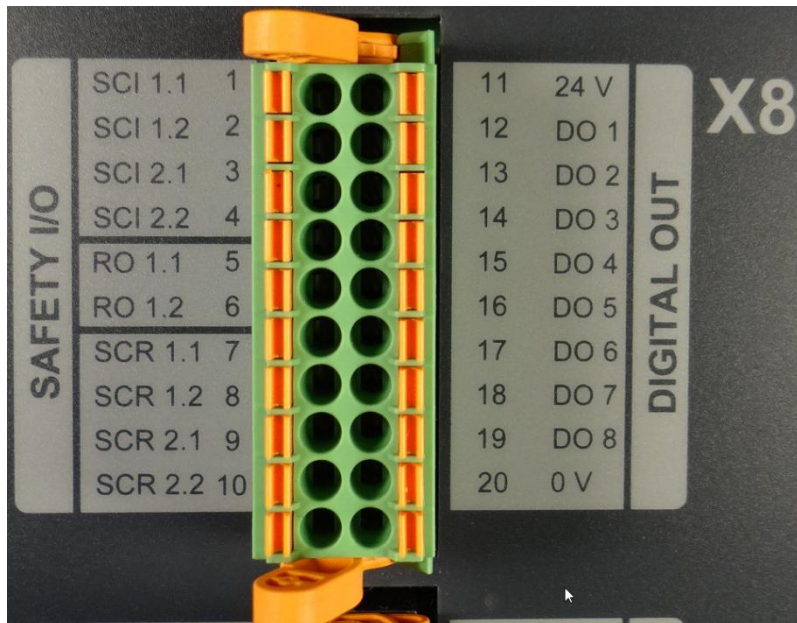
5.5.2 Connecting safety I/O and digital outputs (X8) 连接安全 I/O 和数字输出 (X8)

X8 connector contains safety-chain inputs and outputs, additional relay output (RO), and eight digital outputs.

The wires are connected to the female connector as follows:

X8 连接器包含安全链输入和输出、附加继电器输出（RO）和八个数字输出。

电线连接到母连接器，如下所示：



Terminal no. 端子编号	Terminal text 端子文本	Description 说明
1	SCI 1.1	Safety-chain input channel 1 (+) 安全链输入通道 1 (+)
2	SCI 1.2	Safety-chain input channel 1 (-) 安全链输入通道 1(-)
3	SCI 2.1	Safety-chain input channel 2 (+) 安全链输入通道 2 (+)
4	SCI 2.2	Safety-chain input channel 2 (-) 安全链输入通道 2 (-)
5	RO 1.1	Additional relay output contact 1 附加继电器输出触点 1
6	RO 1.2	Additional relay output contact 2 附加继电器输出触点 2
7	SCR 1.1	Safety-chain relay channel 1 contact 1 安全链继电器通道 1 触点 1
8	SCR 1.2	Safety-chain relay channel 1 contact 2 安全链继电器通道 1 触点 2
9	SCR 2.1	Safety-chain relay channel 2 contact 1 安全链继电器通道 2 触点 1
10	SCR 2.2	Safety-chain relay channel 2 contact 2 安全链继电器通道 2 触点 2

Terminal no. 端子编号	Terminal text 端子文本	Description 说明
11	+24 V	+ 24 V DC supply for all outputs + 24 VDC 源用于所有输出
12	DO 1	Digital output 1 数字输出 1
13	DO 2	Digital output 2 数字输出 2
14	DO 3	Digital output 3 数字输出 3
15	DO 4	Digital output 4 数字输出 4
16	DO 5	Digital output 5 数字输出 5
17	DO 6	Digital output 6 数字输出 6
18	DO 7	Digital output 7 数字输出 7
19	DO 8	Digital output 8, it is recommended to use this output for the Fan + (red wire). See also section 8.4.8 on page 133 . 数字输出 8, 建议将此输出用于风扇+ (红线)。另见第 100 页第 8.4.8 节。
20	0 V	Ground for all outputs, also used for Fan - (black wire) 所有输出接地, 也用于风扇(黑线)



Attention

The digital outputs are galvanically isolated from the IMD circuit by optocouplers. Ground and +24 VDC from the external circuit must be connected to terminal 11 and 20.

注意

数字输出通过光电耦合器与 IMD 电路进行电流隔离。接地和外部电路的+24 VDC 必须连接到端子 11 和 20。

5.5.2.1 Safety I/O 安全 I/O

In order to be able to implement a safety-chain according to ISO 13849, two safety-chain relays (SCR) and two safety-chain inputs (SCI) are implemented in the IMD. See *IMD 100 function description* manual for detailed description of how the safety I/O is implemented and functions.

Safety-chain inputs (SCI) have the same HW specifications as all other digital inputs specified in section [5.5.1](#) on page [58](#).

Safety-chain output (SCR) are relay outputs, protected with a PTC multi-fuse (0.5 A). If the current exceeds the fuse value, the fuse will heat up and disconnect the output. When the fuse is cooled down, it will automatically reconnect the output.

The safety-chain outputs relay contacts have the following HW specifications:

为了能够实施符合 ISO 13849 的安全链, IMD 中实施了两个安全链继电器 (SCR) 和两个安全链输入 (SCI)。有关安全 I/O 的实施方式和功能的详细说明, 请参阅 IMD 100 功能概要手册。

安全链输入 (SCI) 与第 47 页第 5.5.1 节中规定的所有其他数字输入具有相同的硬件规格。

安全链输出（SCR）为继电器输出，由 PTC 自恢复保险丝（0.5 a）保护。如果电流超过保险丝值，保险丝会发热并断开输出。当保险丝冷却后，将自动重新连接输出。

安全链输出继电器触点具有以下硬件规格：

Maximum voltage V max 最大电压 V max	30 V DC
Maximum current 最大电流	0.25 A DC



Attention

The safety-chain inputs must be connected no matter if safety chain is used or not. See [Figure 31](#) on page 63 for detailed information of how to connect the safety-chain inputs when the safety chain is not used.

注意

无论是否使用安全链，都必须连接安全链输入。有关在不使用安全链时如何连接安全链输入的详细信息，请参阅第 51 页的图 31。

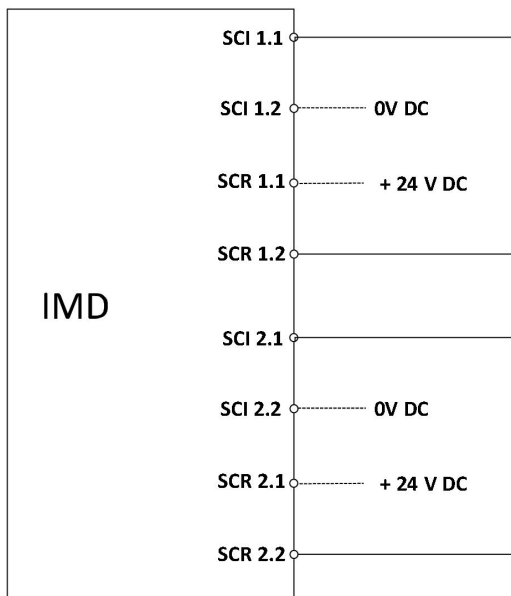


Figure 31 Safety-chain input connections when safety-chain is not used

图 31 未使用安全链时的安全链输入连接

5.5.2.2 Additional relay output 附加继电器输出

The relay output RO has the same characteristics as the safety-chain relays. It is protected with a PTC multi-fuse (0.5 A). If the current exceeds the fuse value, the fuse will heat up and disconnect the output. When the fuse is cooled down, it will automatically reconnect the output. This relay output is a distributed output that can be used for any purpose.

The output RO relay contacts have the following HW specifications:

继电器输出 RO 具有与安全链继电器相同的特性。它由 PTC 自恢复保险丝（0.5 a）保护。如果电流超过保险丝值，保险丝将加热并断开输出。保险丝冷却后，将自动重新连接输出。该继电器输出为分布式输出，可用于任何用途。

输出 RO 继电器触点具有以下 HW 规格:

Maximum voltage V max 最大电压 V max	30 V DC
Maximum current 最大电流	0.25 A DC

5.5.2.3 Digital outputs 数字输出

There are eight digital outputs that can be used for any purpose. The outputs are supplied from X8 supply (terminals 11 and 20).

有八个数字输出可用于任何用途。输出由 X8 电源（端子 11 和 20）供电。



Info

IMD version B only: One of the outputs between DO5 to DO8 must be used for the fan (DO 8 is recommended to be used). The fan wires (1) are routed through the heat sink to the left of the R-ballast.

信息

仅限 IMD 版本 B: 风扇必须使用 DO5 到 DO8 之间的一个输出（建议使用 DO 8）。风扇导线（1）穿过散热器至 R 镇流器的左侧。



The digital outputs have the following HW specifications:

数字输出具有以下硬件规格:

Voltage supply range at X8/11 X8/11 处的电源电压范围	12 to 36 V DC 12 至 36 VDC
Maximum output current 最大输出电流	250 mA DC 250 毫安直流电
Output high 高输出	> supply voltage at X8/11 – 1V DC > X8/11 处的电源电压 - 1VDC
Output low 低输出	< 3 VDC < 3VDC

5.5.3 Connecting 24V (X7) 连接 24V (X7)

Depending on the options of the IMD, X7 can be input or output:

根据 IMD 的选项，X7 可以是输入或输出:

- IMD has “24 VDC out” option: X7 acts as output or input for backup (use of X7 is optional)
IMD 有 “24 VDC 输出” 选项: X7 作为输出或输入备份(使用 X7 可选)
- IMD has no “24 VDC out” option: X7 acts as input (use of X7 is mandatory)
IMD 没有 “24 VDC 输出” 选项: X7 作为输入(必须使用 X7)

The 24 V is used as a supply for the IMD internal control and the following outputs (connected internally): 24 V 用作 IMD 内部控制和以下输出（内部连接）的电源:

- Brake 制动器
- Resolver 编码器

- Temperature sensors 温度传感器
- SSI

X7 has double poles for both plus and minus, to enable chaining the supply. If chaining is not needed any of the inputs can be used.

The following figure illustrates some application examples:

X7 具有正负双极，以实现电源链接。 如果不需要链接，可以使用任何输入。

下图说明了一些应用示例：

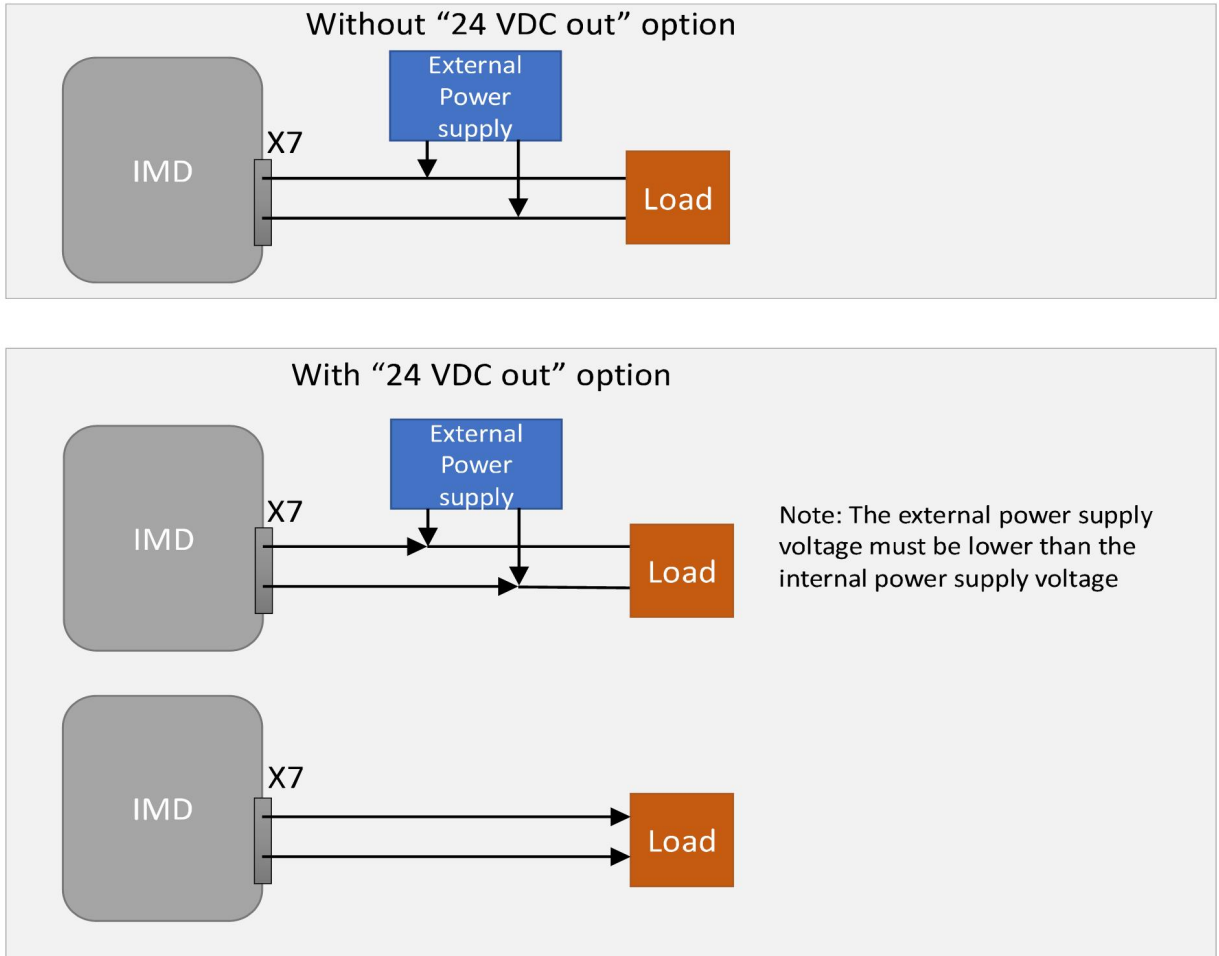


Figure 32 Typical applications

图 32 典型应用

NOTE When an external power supply is connected to X7, consider power that may be drawn from the motor brake output. See section 6.4 on page 79.

注意 当外部电源连接到 X7 时，请考虑可能来自电机制动输出的功率。请参阅第 63 页的第 6.4 节。

With "24 VDC out" option: 24 VDC 输出选项:

Table 4 External power supply specifications

表 4 外部电源参数

<p>Input voltage 输入电压</p>	<p>24 ± 10% V DC No voltage dip (at brake current + 0.25 A DC inrush current) below 20 V DC is allowed. 不允许低于 20 VDC 的电压骤降（在制动电流 + 0.25 安培直流浪涌电流下）。</p>
<p>Input current (IMD only) 输入电流 (仅限 IMD)</p>	<p>Maximum current through X7: 7 A DC. Minimum current calculated (sum) from the following consumptions: 通过 X7 的最大电流: 7 A DC. 根据以下消耗计算的最小电流（总和）： <ul style="list-style-type: none"> • IMD internal + fan: 1 A DC • IMD 内部+风扇: 1 A DC • SSI consumption • SSI 消耗 • Brake consumption • 制动消耗 </p>

Without “24 VDC out” option:没有 “24 VDC 输出” 选项:

Table 5 Internal power supply output and external power supply input specifications

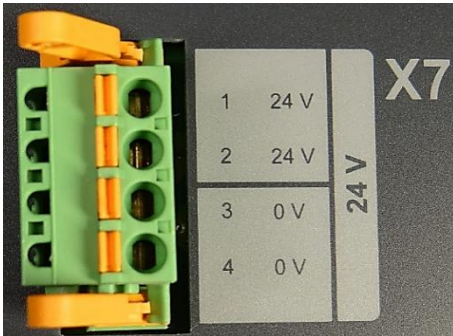
表 5 内部电源输出和外部电源输入规格

<p>Output voltage 输出电压</p>	<p>24 ± 2% V DC</p>
<p>Maximum output current available at X7 X7 可用的最大输出电流</p>	<p>6 A – brake current – SSI encoder current, (the actual currents used by the motor brake and SSI encoder must be subtracted from 6 A). 6 A – 制动电流 – SSI 编码器电流（必须从 6 A 中减去电机制动器和 SSI 编码器使用的实际电流）。</p>
<p>External power supply voltage 外部电源电压</p>	<p>21 to 23.5 V DC. No voltage dip below 20 V DC is allowed. 21 至 23.5 V DC 不允许低于 20 V DC 的电压骤降。</p>
<p>External power supply current (IMD input) 外部电源电流(IMD 输入)</p>	<p>Maximum current through X7: 7 A DC 通过 X7 的最大电流: 7 A DC Minimum current calculated (sum) from the following consumptions: 根据以下消耗计算的最小电流（总和）： <ul style="list-style-type: none"> • IMD internal + fan: 1 A DC • IMD 内部 + 风扇: 1 A DC • SSI consumption • SSI 消耗 • Brake consumption </p>

- 制动消耗

The wires are connected to the female connector as follows:

母连接器的接线方式如下:



Terminal no. 端子编号	Terminal text 端子文本	Description 说明
1, 2	24 V	+ 24 V DC input or output depending on IMD variant and option +24 V DC 输入或输出取决于 IMD 的不同版本和选项
3, 4	0 V	0 V DC input or output depending on IMD variant and option 0 V DC 输入或输出取决于 IMD 的不同版本和选项

6. Functions description 功能概要

This section describes in more details functions that are not described or described in a high-level manner in the IMD 100 function description. The SCI (Safety-chain input) and RFE (Rotation Field Enabled) inputs are safety related, and are fully described in the IMD 100 function description.

本节将更详细地介绍 IMD 100 功能概要中未描述或未进行高级描述的功能。SCI（安全链输入）和 RFE（旋转场启用）输入与安全相关，并在 IMD 100 功能概要中进行了完整描述

6.1 IMD states IMD 状态机

The following flowchart shows the operational states of the IMD, and indicates the conditions for changing from one state to another. Some states are not mentioned since they are path states only, and will not be seen by the user, or omitted for simplicity.

以下流程图显示了 IMD 的工作状态，并指出了从一种状态更改为另一种状态的条件。一些状态没有被提及，因为它们只是路径状态，用户不会看到，或者为了简单起见省略。

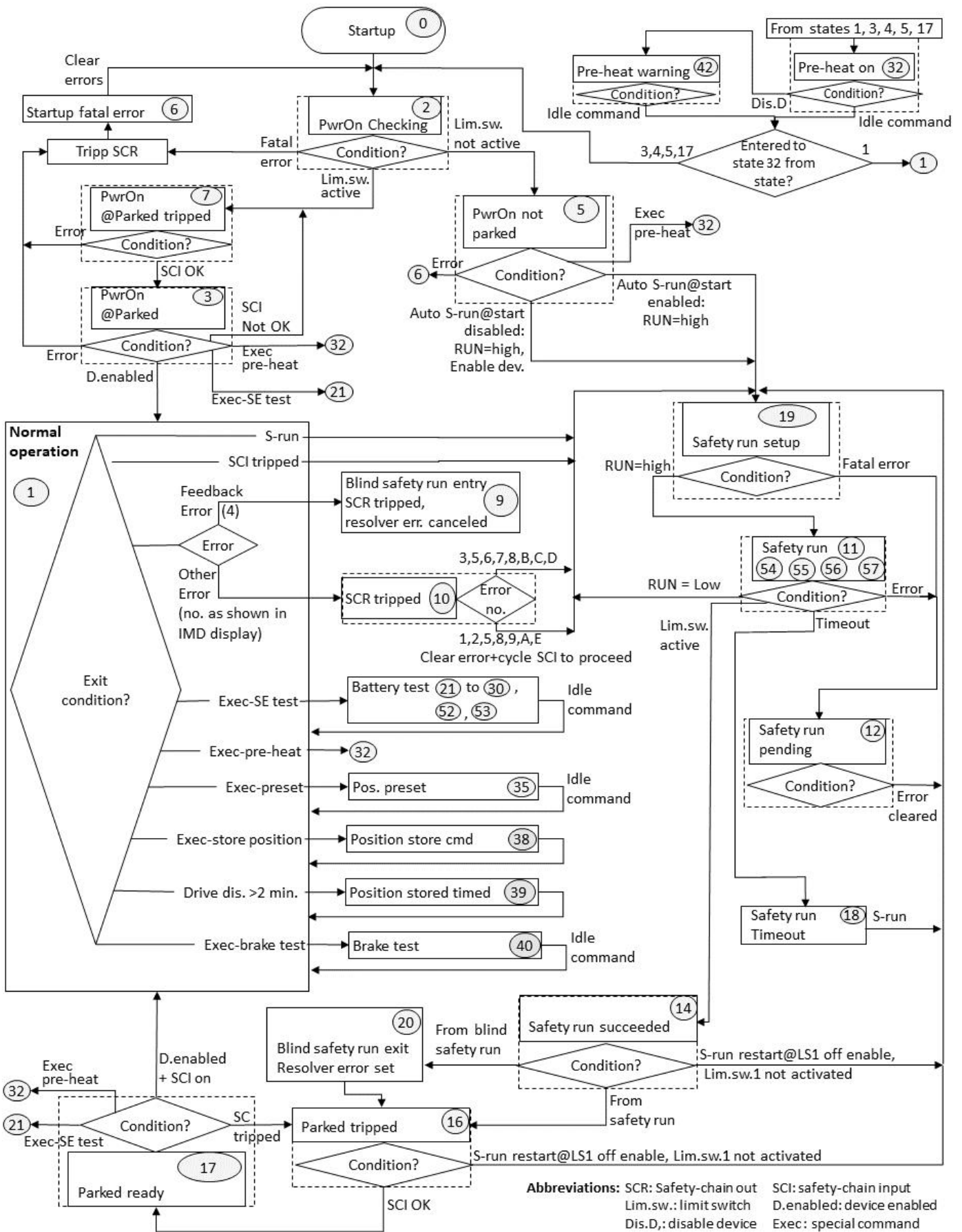


Figure 33 IMD states

图 33 IMD 状态机

The following table describes the states of the IMD (some states are omitted since they will not be seen by the user). In the conditions to proceed column, the conditions for leaving the state are given. Conditions to proceed that are user or application actions (either through the IMD Manager, through the CAN interface or manual operation) are formatted as `monotype`.

下表描述了 IMD 的状态（有些状态被省略，因为用户不会看到它们）。在继续进行的条件栏中，给出了退出状态的条件。用户或应用程序操作（通过 IMD 监控软件、CAN 接口或手动操作）的继续条件被格式化为单一类型。

Table 6 IMD operational states description

表 6 IMD 运行状态说明

No 编号	Name 名称	Description 描述	Conditions to proceed 继续进行的条件
1	Normal operation 正常操作	<p>This state is the state when the IMD is ready to operate and there are no active errors. The condition for entering this state are that the device is enabled (see section 9.4 on page 178 for details). Once in this state, it will remain in this state even if the device is disabled by “Enable dev.” button/CAN command, or low on the RUN input.</p> <p>此状态是 IMD 准备好运行且激活无错误时的状态。进入该状态的条件是设备已使能（详见第 135 页第 9.4 节）。设备一旦处于这种状态会一直保持，即使设备被 “Enable dev.” 按钮/CAN 命令禁用，或 RUN 输入低。</p>	<ul style="list-style-type: none"> • Active error 错误处于激活状态 • +Safety-chain input tripped 安全链输入跳闸 • Safety run execution 安全运行执行 • Manual operation*手动操作* • Execution of special commands 特殊命令的执行
2	PwrOn checking 上电检查	<p>Power on checking. This state is the first state during start-up and a return step if start-up error was cleared. In this step the IMD makes a self-test, check for errors and check whether a limit switch is activated, in order to determine whether the present position is known.</p> <p>上电检查。此状态是启动期间的第一个状态，如果启动错误被清除，则为返回步骤。在此步骤中，IMD 进行自检，检查错误并检查限位开关是否激活，以确定当前位置是否已知。</p>	<ul style="list-style-type: none"> • Error is active 错误激活 • Limit switch is active 限位开关处于激活状态 • Limit switch is not active 限位开关未激活
3	PwrOn @Parked 停机时上电	<p>Power on at parked. This state is entered if a limit switch is activated at start-up.</p> <p>在停机状态下上电。如果在上电时限位开关被激活，则进入此状态。</p>	<ul style="list-style-type: none"> • Error is active 错误处于激活状态 • Safety chain input is OK, and the device is enabled (RUN is high and Enable dev. is set)安全链输入正常，且设备已启用（RUN 高电平且使能） • Execution of special

No 编号	Name 名称	Description 描述	Conditions to proceed 继续进行的条件
			<p>command pre-heat 执行特殊指令预热</p> <ul style="list-style-type: none"> • Execution of special command SE-test 执行特殊命令 SE-测试 • Manual operation*手动操作*
5	PwrOn not parked 未停机时上电	<p>Power on not parked. This state is entered if no limit switch is activated at start-up, and thus the position is unknown. In this state the IMD will check the state of the Auto safety run enabled bit in reg. 0x01.</p> <p>未停机时上电。如果启动时未激活限位开关，则进入此状态，因此位置未知。在这种状态下，在此状态下，IMD 将检查 reg.0x01 中自动安全运行启用位的状态。</p>	<ul style="list-style-type: none"> • Error is active 错误处于激活状态 • Auto safety run enabled = 0: RUN = high and Enable dev. is set 自动安全运行启用=0: RUN=高，并设置了启用设备 • Auto safety run enabled = 1: RUN = high. "Enable dev." is set automatically by the IMD 自动安全运行启用=1: RUN=高。“启用设备”由 IMD 自动设置 • Execution of special command pre-heat 执行特殊指令预热 • Manual operation*手动操作*
6	Start-up error 启动错误	<p>An error is found during the start-up sequence. SCR outputs 1 and 2 are tripped, and the IMD remains in this state until the errors are cleared by the user or the application SW. After the errors are cleared, the SCI inputs must be cycled to initiate restart.</p> <p>在启动过程中发现错误。SCR 输出 1 和 2 跳闸，IMD 保持此状态，直到用户或应用程序 SW 清除错误。清除错误后，必须循环 SCI 输入以启动重启。</p>	<ul style="list-style-type: none"> • Errors cleared and SCI 1 and 2 are cycled 错误被清除，SCI 1 和 SCI 2 被循环
7	PwrOn@Parked tripped 停机时上电，且安全链断开	<p>The blade is fully feathered (limit switch activated, but the state of the safety chain is either unknown (when entering the state) or tripped.叶片完全顺桨（限位开关激活，但安全链的状态未知（进入状态时）或跳闸。</p>	<ul style="list-style-type: none"> • SCI inputs indicate that the safety chain is not tripped (SCI OK)SCI 输入表明安全链没有跳闸 (SCI 正常) • Error is active 错误处于激活状态

No 编号	Name 名称	Description 描述	Conditions to proceed 继续进行的条件
9	Blind safety run initiate 开环运行启动	<p>The IMD can only enter this state from normal operation (1) and if the resolver is not OK. It is used to create another entry point to the safety run so that blind safety run parameter values will be used. It also temporarily cancels the feedback error (the error will be set again when exiting the safety run at state 20). This is needed in order to override the error check in states 19 and 11.</p> <p>IMD 只能在正常模式（1）和编码器不正常时进入此状态。它用于创建安全运行的另一个入口点，以便使用开环运行参数值。它还暂时取消了反馈错误（在状态 20 退出安全运行时将再次设置该错误）。这是为了覆盖状态 19 和 11 中的错误检查所必需的。</p>	<ul style="list-style-type: none"> None. The IMD automatically proceeds to safety run setup (state 19) <p>无。IMD 自动进入安全运行设置(状态 19)</p>
10	SCR tripped SCR 跳闸	<p>An error occurred in normal operation state. The IMD automatically trips the SCR outputs 1 and 2.</p> <p>A special case is for errors 5 and 8. If these errors were triggered by DC-link Vmax or DC-link Vlow, the IMD automatically proceeds to safety run (19). If these errors were triggered by HW DC-link or DC-link Vmin, the IMD will stay in state 10 until the error is cleared and SCI is cycled.</p> <p>正常模式状态下发生错误。IMD 自动使 SCR 输出 1 和 2 跳闸。</p> <p>错误 5 和 8 是一种特殊情况。</p> <p>如果这些错误是由直流母线 V max 或直流母线 Vlow 触发的，IMD 会自动进入安全运行 (19)。</p> <p>如果这些错误是由 HW 直流母线电压或直流母线 Vmin 触发的，IMD 将保持状态 10，直到错误被清除且 SCI 断开。</p>	<ul style="list-style-type: none"> If the error that caused state 10 is error number 3, 6, 7. B, C or D, the IMD automatically proceeds to safety run (19). 如果导致状态 10 的错误是错误编号 3、6、7。B、C 或 D，IMD 会自动进入安全运行 (19)。 If the error number is different than 3, 6, 7. B, C or D, clear errors and cycle SCI inputs 如果错误编号不同于 3、6、7。B、C 或 D，清除错误并断开 SCI 输入 <p>See also description to the left. 另请参阅左侧的说明。</p>
11	Safety run step 0 安全运行步骤 0	<p>The IMD executes a safety run: the motor runs with the configured speed until a limit switch is activated, a configured timeout is reached, or the position for step 1 is reached (and speed profile is enabled). If an error occurs during the safety run a different error state path is taken.</p> <p>See also state 54 to 57.</p> <p>IMD 执行安全运行：电机以配置的速度运</p>	<ul style="list-style-type: none"> Active error – will proceed to Safety run pending (12) Limit switch active Timeout Position for step 1 reached (state 54) Run input is low

No 编号	Name 名称	Description 描述	Conditions to proceed 继续进行的条件
		<p>行，直到激活限位开关、达到配置的超时或达到步骤 1 的位置（并启用速度配置文件）。</p> <p>如果在安全运行期间发生错误，则会采用不同的错误状态路径。</p> <p>另见状态 54 至 57。</p>	<p>RUN 信号为低电平</p>
12	<p>Safety run pending 安全运行待定</p>	<p>An error occurs during the safety run. 安全运行期间发生错误。</p>	<ul style="list-style-type: none"> • Clear errors 清除错误
14	<p>Safety run succeeded 安全运行成功</p>	<p>The performed safety run ended with activation of a limit switch. IMD determines whether to proceed to state 16 or 20 (safety run or blind safety run was performed). 执行的安全运行在限位开关启动后结束。IMD 确定是否进入状态 16 或 20（执行安全运行或开环运行）。</p>	<ul style="list-style-type: none"> • If S-run restart@LS1 off is enabled, and limit switch 1 not activated (not after blind safety run) 如果 S-run restart@LS1 off 已启用，且限位开关 1 未激活（非开环运行后） • From safety run 从安全运行 • From blind safety run 从开环运行
16	<p>Parked tripped 停机跳闸</p>	<p>End of a safety run after the limit switch is activated. It can also enter this state if in Parked ready and the safety chain inputs are not OK. 限位开关激活后安全运行结束。 如果处于停机就绪状态且安全链输入不正常，也可以进入此状态。</p>	<ul style="list-style-type: none"> • Safety-chain inputs reset 安全链输入复位 • If S-run restart@LS1 off is enabled, and limit switch 1 not activated 如果 S-run restart@LS1 off 已启用，且限位开关 1 未激活 • Safety-run is initiated 安全运行启动
17	<p>Parked ready 停机就绪</p>	<p>Device enable will be disabled automatically when the IMD enters this state. The IMD waits for Enable dev. in order to go to normal operation. 当 IMD 进入此状态时，将自动禁用设备启用。IMD 等待设备启用才能正常操作。</p>	<ul style="list-style-type: none"> • Active error or safety-chain inputs missing 激活错误或缺少安全链输入 • Enable dev. 设备启用 • Safety-run is initiated 启动安全运行 • Execution of special command SE-test 执行特殊指令 SE 测试

No 编号	Name 名称	Description 描述	Conditions to proceed 继续进行的条件
			<ul style="list-style-type: none"> Manual operation*手动操作*
18	Safety run timeout 安全运行超时	The safety run did not reach a limit switch before the configured timeout elapsed. 在配置的超时时间过去之前，安全运行未到达限位开关。	<ul style="list-style-type: none"> Initiate a new safety run with S-run or restart the IMD 使用 S-run 启动新的安全运行或重新启动 IMD Manual operation*手动操作*
19	Safety run setup 安全运行设置	The IMD checks whether it can perform a safety run, and if yes, whether it should be a safety run or blind safety run. If there are no active errors the Device enable will be set automatically. IMD 检查是否可以执行安全运行，如果可以，则检查是安全运行还是开环运行。如果激活无错误，将自动设置设备启用。	<ul style="list-style-type: none"> Active error – will proceed to Safety run pending (12) 激活错误 – 将继续安全运行待定 (12) RUN input is high RUN 输入高
20	Blind safety run exit 开环运行出口	The feedback error that was cancelled in state 9, is set back.在状态 9 中取消的反馈错误被重置。	<ul style="list-style-type: none"> None 无
21-30, 52, 53	Safe energy test 后备电源检测	Safe energy test is on going. 后备电源测试正在进行中。	<ul style="list-style-type: none"> Execution of special command Idle 执行特殊命令闲置
32	Pre-heat 预热	Preheating of the motor is ongoing 正在对电机进行预热	<ul style="list-style-type: none"> Execution of special command Idle 执行特殊命令闲置 Device disabled 设备禁用
35	Pos. Preset 位置预设	Changing the resolver value of the actual position is ongoing.正在更改实际位置的编码器值。	<ul style="list-style-type: none"> Execution of special command Idle 执行特殊命令闲置
38	Store position 存储位置	Storing the actual position in the non-volatile memory is ongoing. 正在断电保持存储器中存储实际位置。	<ul style="list-style-type: none"> None. The IMD automatically returns to normal operation.无。IMD 自动恢复正常操作。
39	Store position timed 存储位置定时	The IMD stores actual position in the EEPROM, if the device is disabled and the resolver value is not the same as the last stored actual position, Automatically every 2 minutes. IMD 在 EEPROM 中存储实际位置，如果设备被禁用，且编码器值与上次存储的实际位置不一致，则自动每 2 分钟保存一次。	<ul style="list-style-type: none"> None. The IMD automatically returns to normal operation. 无。IMD 自动恢复正常操作。

No 编号	Name 名称	Description 描述	Conditions to proceed 继续进行的条件
40	Brake test 刹车检测	Brake test is ongoing 正在进行自动检测	<ul style="list-style-type: none"> • Execution of special command Idle 执行特殊命令闲置
42	Pre-heat warning 预热警报	The Device enable was disabled in Pre-heat. When in this state, the pre-heat is turned off.设备启用在预热中被禁用。在此状态下，预热关闭。	<ul style="list-style-type: none"> • Execution of special command Idle 执行特殊命令闲置
54	Safety run step 1 安全运行步骤 1	<p>The IMD executes a safety run: the motor runs with the configured speed until a limit switch is activated, a configured timeout is reached, or the position for step 2 is reached.</p> <p>If an error occurs during the safety run a different error state path is taken.</p> <p>IMD 执行安全运行:电机以配置的速度运行，直到限位开关被激活，达到配置的超时时间，或达到步骤 2 的位置。</p> <p>如果在安全运行期间发生错误，则采用不同的错误状态路径。</p>	<ul style="list-style-type: none"> • Active error – will proceed to Safety run pending (12) 激活错误 – 将继续安全运行待定 (12) • Limit switch active 限位开关激活 • Timeout 超时 • Position for step 2 reached (state 55)达到步骤 2 的位置 (状态 55) • Run input is low 运行输入低
55	Safety run step 2 安全运行步骤 2	<p>The IMD executes a safety run: the motor runs with the configured speed until a limit switch is activated, a configured timeout is reached, or the position for step 3 is reached.</p> <p>If an error occurs during the safety run a different error state path is taken.</p> <p>IMD 执行安全运行:电机以配置的速度运行，直到限位开关被激活，达到配置的超时时间，或达到步骤 3 的位置。</p> <p>如果在安全运行期间发生错误，则采用不同的错误状态路径。</p>	<ul style="list-style-type: none"> • Active error – will proceed to Safety run pending (12) 激活错误 – 将继续安全运行待定 (12) • Limit switch active 限位开关激活 • Timeout 超时 • Position for step 3 reached (state 56)达到步骤 3 的位置 (状态 56) • Run input is low 运行输入低
56	Safety run step 3 安全运行步骤 3	<p>The IMD executes a safety run: the motor runs with the configured speed until a limit switch is activated, a configured timeout is reached, or the position for step 4 is reached.</p> <p>If an error occurs during the safety run a different error state path is taken.</p> <p>IMD 执行安全运行:电机以配置的速度运行，直到限位开关被激活，达到配置的超时时间，或达到步骤 4 的位置。</p> <p>如果在安全运行期间发生错误，则采用不同的错误状态路径。</p>	<ul style="list-style-type: none"> • Active error – will proceed to Safety run pending (12) 激活错误 – 将继续安全运行待定 (12) • Limit switch active 限位开关激活 • Timeout 超时 • Position for step 4 reached (state 57)达到步骤 4 的位置 (状态 57)

No 编号	Name 名称	Description 描述	Conditions to proceed 继续进行的条件
			<ul style="list-style-type: none"> Run input is low 运行输入低
57	Safety run step 4 安全运行步骤 4	<p>The IMD executes a safety run: the motor runs with the configured speed until a limit switch is activated, or a configured timeout is reached.</p> <p>If an error occurs during the safety run a different error state path is taken.</p> <p>IMD 执行安全运行:电机以配置的速度运行,直到限位开关被激活,达到配置的超时时间。</p> <p>如果在安全运行期间发生错误,则采用不同的错误状态路径。</p>	<ul style="list-style-type: none"> Active error – will proceed to Safety run pending (12) 激活错误 - 将继续安全运行待定 (12) Limit switch active 限位开关激活 Timeout 超时 Run input is low 运行输入低
58	Pre-safety run setup 预安全运行设置	<p>The IMD determines whether to reconnect mains for the safety run</p> <p>IMD 决定是否重新连接电源以保证安全运行</p>	<ul style="list-style-type: none"> Continues automatically to state 19.自动继续到状态 19。
59	Manual operation 手动操作	<p>The motor is controlled by digital input 10 (“-” direction) and digital input 11 (“+” direction).</p> <p>电动机由数字输入 10(“-”方向)和数字输入 11(“+”方向)控制。</p>	<ul style="list-style-type: none"> Digital input 12 goes low. 数字输入 12 变低。
<p>* Manual operation is a combination of digital input 12 being high and either digital input 10 or 11 being activated.手动操作是数字输入 12 高和数字输入 10 或 11 激活的组合。</p>			

6.2 Internal flags 内部标志

The IMD uses some internal flags that are visible as status flags. The same flag may also be mapped to a register in order to be able to read directly, without need to mask the result (the register value is either zero or one).

See also general definition of the parameter in the [Parameter list](#), and bit mapping in Reg. 0xD8 (section [13.2.11](#) on page [280](#)) and Reg. 0x40 (section [13.2.4](#) on page [269](#)).

IMD 使用一些可见的内部标志作为状态标志。同样的标志也可以映射到寄存器,以便能够直接读取,而无需屏蔽结果(寄存器值为 0 或 1)。

另请参见参数列表中参数的一般定义以及 Reg. 0xD8(第 213 页 13.2.11 节)和 Reg. 0x40(第 206 页 13.2.4 节)中的位映射。

Table 7 Internal flags

表 7 内部标志

Flag 标志	Register 寄存器	Description 描述
SCR 1 and 2 SCR 1 和 2	0xD8 bit 10 0xD8 位 10	Indicates the state of the Safety-chain relays. 0 = relays tripped, 1 = relays are ON. This parameter also indicates whether the IMD can be enabled or not. When the relays are tripped, the IMD cannot be enabled without clearing the errors and cycling the safety-chain inputs. 指示安全链继电器的状态。0=继电器跳闸，1=继电器开启。此参数还指示是否可以启用 IMD。当继电器跳闸时，如果不清除错误并循环安全链输入，则无法启用 IMD。
Dev.Enabled 设备启用	0x40 bit 0 0 x40 位 0	Dev.Enabled is turned on when both “Enable dev.” and RUN are active.当 “Enable dev.” 和 RUN 都处于激活状态时，dev. enabled 被打开。
GO	0xD8 bit 11 0xD8 位 11	Go is turned on when the IGBT is enabled. In normal circumstances, it will be turned on together with Dev.Enabled is turned on (when both “Enable dev.” and RUN are active). However, if for some reason the IGBT is not enabled, it will remain off. 当 IGBT 启用时，Go 被打开。在正常情况下，它将与 Dev.Enabled 一起打开（当 “Enable Dev.” 和 RUN 都处于激活状态时）。但是，如果由于某种原因 IGBT 未启用，它将保持关闭状态。
Mains disconnected 电源断开	0xD8 bit 14 0xD8 位 14	State of the connection between 400VAC to the DC-link. 1: DC-link is disconnected 0: DC-link is connected Note: this flag is used in the IMD Manager to show the power source of the DC-link. 400VAC 与直流母线之间的连接状态。 1: 直流母线断开 0: 直流母线已连接 注意:此标志在 IMD 监控软件中用于显示直流母线的电源。
Brake output 制动输出	0xD8 bit 15 0xD8 位 15	The brake output is active.制动输出激活。
Brake delay 制动延迟	0x40 bit15 0x40 位 15	The brake is in the process of either being activated or deactivated (brake delay is on).制动器处于激活或停用过程中（制动器延迟开启）。
Logic-5	0xDF	The state of Logic-5 logical function (mapped to DO 5)Logic-5 逻辑函数的状态(映射到 DO 5)
Logic-6	0xDE	The state of Logic-6 logical function (mapped to DO 6)Logic-6 逻辑函数的状态(映射到 DO 6)
Logic-7	0xE1	The state of Logic-7 logical function (mapped to DO 7)Logic-7 逻辑函数的状态(映射到 DO 7)
Logic-8	0xE0	The state of Logic-8 logical function (mapped to DO 8)Logic-8 逻辑函数的状态(映射到 DO 8)
SCR 1 and 2 SCR 1 和 2	0xE2	The same as 0xD8 bit 10 (SCR 1 and 2)与 0xD8 位 10 相同（SCR 1 和 2）

Flag 标志	Register 寄存器	Description 描述
GO	0xE3	The same as 0xD8 bit 11 (GO)与 0xD8 位 11 (GO) 相同
RUN	0xE8	The state of RUN digital input RUN 数字输入的状态
I fault	0xE9	If 1: Internal error in the power section (an error will be generated as well)If 1: 电源部分内部错误（也将生成错误）
I ballast	0xEA	Internal state of the Ballast circuit. 0: Ballast resistor is OFF, 1: Ballast resistor is ON 镇流器电路的内部状态。 0: 制动电阻关闭, 1: 制动电阻打开

6.3 Safe energy monitoring 后备电源监测

The IMD monitors continuously the SE voltage. Using CAN/CANopen or the IMD Manager, it is possible to read the actual SE voltage. IMD 122 C has an extra input for measurement of the mid-point voltage. A wrong mid-point voltage, SE voltage or both, is an indication that a battery or ultra-capacitor module are defective). No warning or configuration are associated with this function, and the IMD does not take any action or evaluation. Evaluating the value and taking actions is done by external controller.

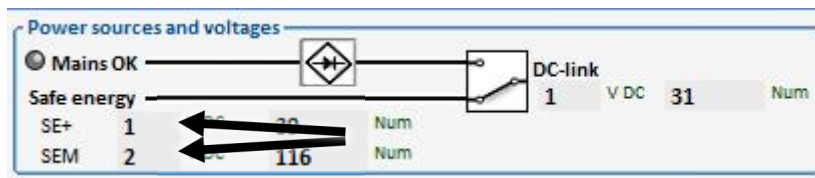
If the SE voltage is below SE Vlow parameter value, a “POWERVOLTAGE sources < min” warning is generated, it is not possible to disconnect mains either from the IMD Manager or CAN/CANopen.

IMD 持续监测 SE 电压。使用 CAN/CANopen 或 IMD 监控软件，可以读取实际 SE 电压。IMD 122 C 具有用于测量中点电压的额外输入。错误的中点电压（SE 电压或两者）表示电池或超级电容器模块有缺陷）。没有与此功能相关的警告或配置，IMD 不会采取任何行动或评估。评估价值和采取行动由外部控制器完成。

如果 SE 电压低于 SE Vlow 参数值，则会生成 “POWERVOLTAGE sources < min” 警告，无法从 IMD 监测软件或 CAN/CANopen 断开主电源。

NOTE If no SE source is connected, the measured values of SE+ and SEM are random (0 to DC-link voltage) due to the protection circuit or the charger. However, the charger will detect it and report an error.

注：在没有接入 SE 源的情况下，由于保护电路或充电器的原因，SE+和 SEM 的测量值为随机值(0 ~ 直流母线电压)。然而，充电器会检测到它并报告错误。



6.4 Brake control 制动控制

The brake system is an integrated part of the pitch system. The brake is a negative brake, which means, that it is spring activated and brakes the blade motor whenever there is no power applied to the brake. The brakes are powered directly from the IMD (24 V DC). The brake is automatically activated/deactivated when either the drive enable (RUN) digital input is changes, or an Enable command OFF/ON is sent to the IMD.

The motor brake is supplied from the internal power supply or from X7. The motor brake current through the power switch can be configured to high or low, which optimises open circuit detection of the used brake.

制动系统是变桨系统的一个组成部分。制动器为负制动器，这意味着，它是弹簧启动的，并在没有电力供给时制动叶片电机。制动器直接由 IMD（24V DC）供电。当更改驱动器启用(RUN)数字输入，或发送应用命令 OFF/ON 时，制动器将自动激活/停用。

电机制动器由内部电源或 X7 供电。通过电源开关的电机制动电流可配置为高或低，从而优化对所用制动器的断路检测。

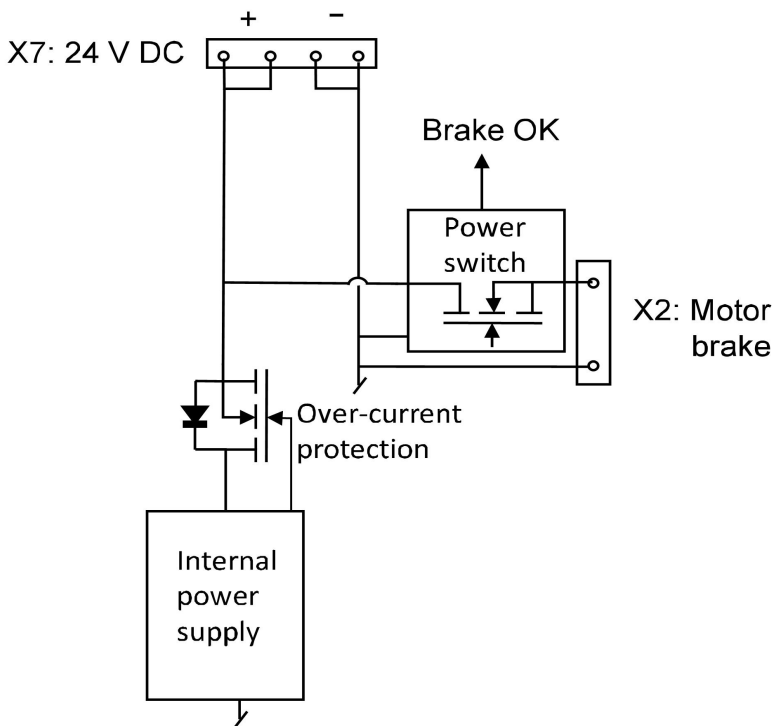
Table 8 Brake current settings 表 8 制动电流设置

Brake current 制动电流	Setting 设置
Less than 2 A 少于 2 A	Low 低
More than 2 A 大于 2 A	High 高



The following figure shows a simplified circuit diagram (IMD with internal power supply) of the relevant internal connections to X2:

下图显示了 X2 相关内部连接的简化电路图（带有内部电源的 IMD）：



The power switch has overcurrent, short-circuit protection, as well as open circuit detection.

The over-current and short-circuit protection are based on the switch temperature, approximately 8 A. The short-circuit initial current is higher.

NOTE The current limit from the internal power supply is approximately 6 A. If there is a 24 V backup connected to X7, a short-circuit (initial) or excessive current will be drawn from the external power supply.

The brake OK signal indicates No open circuit and temperature not too high. It is shown in the IMD Manager and available in CAN.

电源开关具有过电流、短路保护以及断路检测功能。

过电流和短路保护基于开关温度，约为 8 A。短路初始电流较高。

注：内部电源的电流限制约为 6 A。如果有 24 V 备用电源连接到 X7，则外部电源将产生短路（初始）或过大电流。

制动器正常信号表示无断路和温度不过高。它在 IMD 监控软件中显示，并在 CAN 中可用。

6.4.1 Brake engagement (Brake output OFF) 制动器接合（制动器输出关闭）

Before starting the brake engagement sequence, the motor output of the IMD is ON, which means that the Run input is high, and the Enable dev. is active. The brake output is ON (brake disengaged).

Once the Run input is set to Low or the Enable dev. is deactivated, the IMD will stop the blade motor motion with the pre-configured (ramp limit) deceleration ratio. When the speed reaches zero and after 50 ms fixed delay, the brake output is turned OFF. While the speed is zero at this point, the modulation to the motor is still ON to ensure that the blade motor holds its position. After the preconfigured brake output OFF delay has passed, the modulation to the motor stops.

The brake delay purpose is to ensure that the brake efficiency is 100% before stopping the modulation (position control). The following figure illustrates the described sequence.

在启动制动器接合顺序之前，IMD 的电机输出为开启，这意味着 Run 输入为高，Enable dev. 处于激活状态。制动输出开启(制动断开)。

一旦 Run 输入设置为“低”或“Enable dev.” IMD 将以预先配置的（坡道限制）减速比停止叶片电机运动。当速度达到零并且经过 50 毫秒固定延迟后，制动器输出关闭。此时速度为零时，但对电机的调制仍处于开启状态，以确保叶片电机保持其位置。在预先配置的制动输出关闭延迟过后，对电机的调制停止。

制动延迟的目的是在停止调制（位置控制）之前确保制动效率为 100%。下图说明了所描述的顺序。

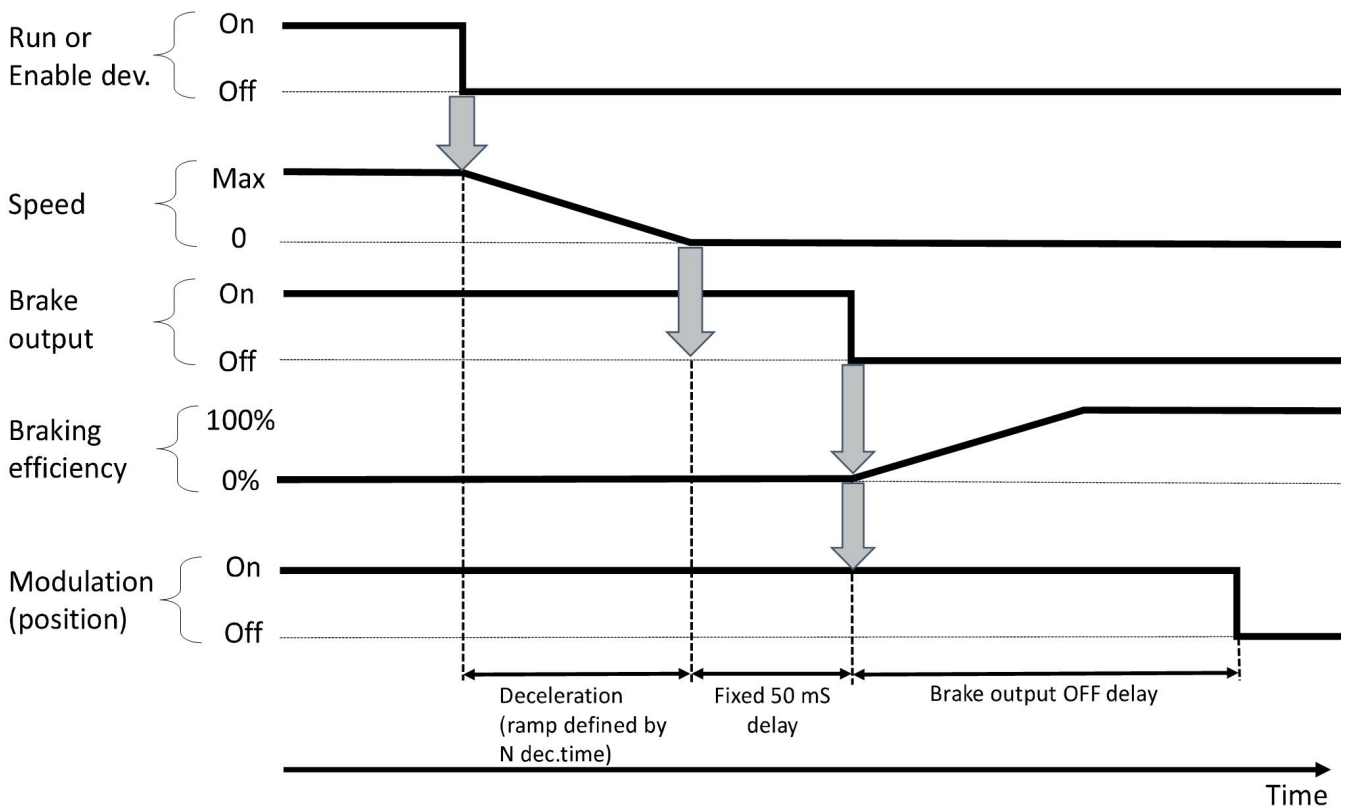


Figure 34 Brake engagement sequence

图 34 刹车抱闸顺序



Info 信息

[Figure 34](#) on page [81](#) illustrates a case where the blade motor is stopped and

brake activated while in motion. If the blade motor is not in motion the speed is already zero and the Ramp-limit deceleration time is therefore equal with zero.

第 64 页的图 34 说明了叶片电机在运动时停止并激活制动器的情况。如果叶片电机未运动，则速度已经为零，因此，坡道限制减速时间等于零。

6.4.2 Brake disengagement (Brake output ON) 制动脱离（制动器输出开启）

Before starting the brake engagement sequence, the motor output of the IMD is OFF, which means that either the Run input is low, or the Enable dev. is inactive, or both. The brake output is OFF (brake engaged).

When RUN input is set to high and the Enable dev. is active, the IMD starts the modulation to fix the blade motor position. After a fixed 15 ms delay, the brake output is turned ON. When the brake output ON delay has passed, the IMD will ramp up the speed in order to pitch the blade to the desired position. The following figure illustrates the described sequence (the order of the of the signals/function is different compared with [Figure 34](#) on page [81](#) for simplicity reasons).

在启动制动器接合顺序之前，IMD 的电机输出关闭，这意味着 Run 输入低，或 Enable dev 处于非激活状态，或两者兼有。制动器输出关闭（制动器接合）。

当 RUN 输入设置为高且 Enable dev. 激活时，IMD 开始调制以固定叶片电机位置。在经过固定的 15 毫秒延迟后，制动器输出开启。当制动器输出开启延迟过后，IMD 将提高速度，以便将叶片变桨到所需位置。下图说明了所描述的顺序（为简单起见，信号/功能的顺序与第 64 页的图 34 不同）。

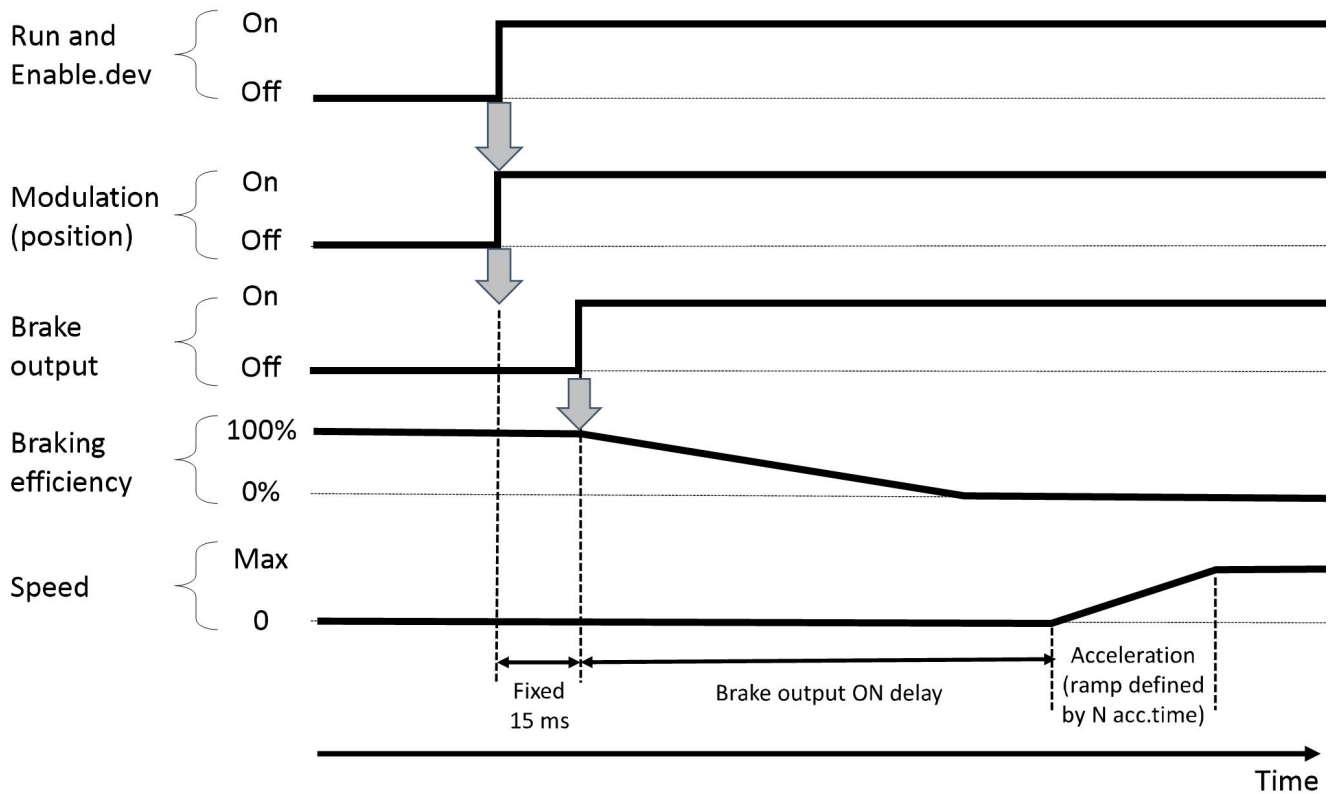


Figure 35 Brake disengagement sequence

图 35 刹车松闸顺序

7. Communication 通信

There are two ways to communicate with the IMD:与 IMD 通信有两种方式:

- CAN/CANopen
- Serial interface over USB (Service)USB 串行接口（服务）

The CAN/CANopen communication is used for communication with the Pitch Motion Controller (PMC) or the main controller if the pitch motion controller is implemented in the main controller application. The serial interface is used for communicating with a PC running the IMD Manager.

CAN/CANopen 通信用于与变桨控制器（PMC）进行通讯，或者直接与主控控制器通讯。串口用于电脑和驱动器之间进行通讯，电脑需安装 IMD Manager 软件。



Info

When using the IMD Manager while the IMD is also connected to CAN/CANopen interface, the CAN/CANopen PDO (Process Data Object) will overwrite data sent from the IMD Manager through the service port on PDO updates.

信息

如果同时使用串口和 CAN/CANopen 接口与驱动器进行通讯，传输的数据会被彼此覆盖

7.1 CAN/CANopen interface CAN/CANopen 接口

The proprietary CAN interface requires that each unit in the same network has its own addresses, one for receiving and one for sending. These two addresses are pre-configured from the factory. 专有 CAN 接口要求同一网络中的每个单元都有自己的地址，一个用于接收，一个用于发送。这两个地址是出厂时预先配置的。

The IMD has also a HW switch on the front for offset (node ID) of the addresses so it is not necessary to SW configure the IDs for each IMD. The switch can be set during installation of the IMD.



IMD 前面还有一个硬件开关，用于地址的偏移量（节点 ID），因此无需为每个 IMD 配置 ID。可在安装 IMD 期间设置该开关。

NOTE It is recommended to read only the parameters needed for the control of the IMD, thus avoiding overload of the CAN bus.

注：建议仅读取 IMD 控制所需的参数，从而避免 CAN 总线过载。

7.1.1 CANopen network structure and management CANopen 网络结构与管理

The implementation of the CAN network structure can vary. The following figure illustrates the basic CAN network implementation.

CAN 网络结构的实现可能会有所不同。下图说明了基本的 CAN 网络实现方式。

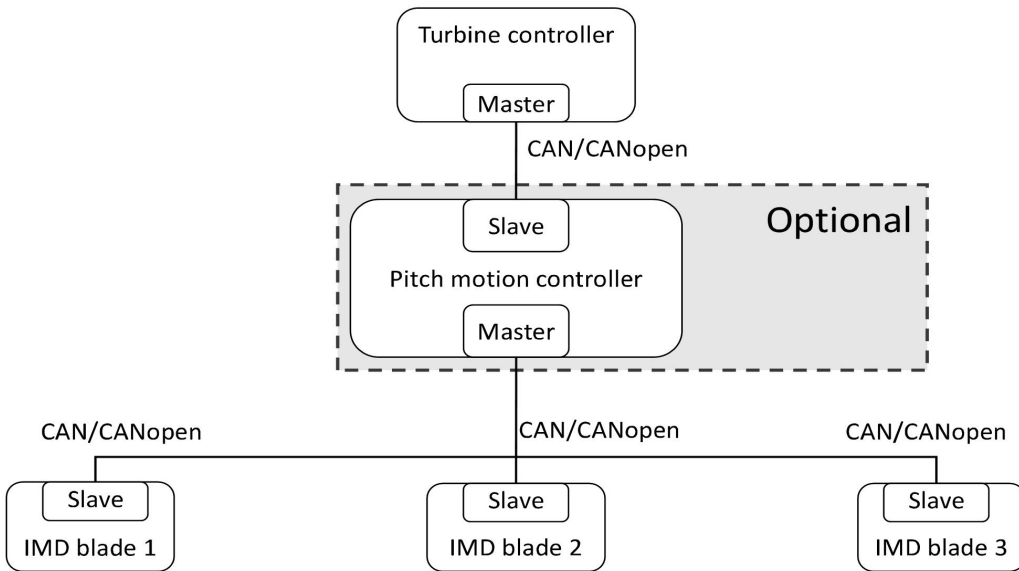


Figure 36 basic CAN network implementation

图 36 CAN 网络基本实现

In order to control a CANopen slave via the NMT service, a set of commands are defined:

为了通过 NMT 服务控制 CANopen 从站，定义了一组命令：

Command value 命令值	Description 描述
0x01	Go to operational 进入可操作
0x02	Go to stopped 停止
0x80	Go to pre-operational 进入预操作
0x81	Go to reset application 进入重置应用程序
0x82	Go to reset communication 进入重置通信

The following example will make a slave with Node ID 1, to enter pre-operational state:

以下示例将使节点 ID 为 1 的从站进入预操作状态：

CAN ID	Data 数据
0	0x80 0x01

**Info**

The states referred to here, are CANopen states and not general IMD states. PDO's will only be active when the slave is in state operational. SDO is active in both pre-operational and operational.

信息

这里提到的状态是 CANopen 状态，而不是一般的 IMD 状态。只有当从服务器处于可操作状态时，PDO 才会被激活。SDO 在预操作和操作中都是处于激活状态。

7.1.2 CAN proprietary Interface CAN 专用接口

The actual addresses of the IMDs, are the configured base addresses + the switch value (1 to 14). For example, if the configured base value is 0x200 and the CAN switch is set to 3, the address will be 0x203 (515 decimal).

The following table describes the CAN interface default values:

IMD 的实际地址是配置的基址+开关值（1 到 14）。例如，如果配置的基值为 0x200，且 CAN 开关设置为 3，则地址将为 0x203（十进制 515）。

下表描述了 CAN 接口的默认值：

Table 9 CAN proprietary Interface

表 9 CAN 专用接口

Device address 设备地址	Short symbol 短符号	Default value 默认值	Parameter register number in the IMD IMD 中的参数寄存器编号
Receiving address 接收地址	Rx ID	0x200 + Switch ID	0x68
Sending address 发送地址	Tx ID	0x180 + Switch ID	0x69
Bit rate*码率	Baudrate (kbps)波特率(kbps)	500	0x73

* The bit rate is initialized only at power-up. It is not possible to change the speed on the fly.

The CAN interface implementation in the IMD is a proprietary protocol, which is a simpler variant of the CANopen. However, if nodes other than IMDs and DEIF PMC or DEIF main controller are to be implemented in the same network, it is recommended to use CANopen, which is a universal protocol.

It is possible to configure the IMD to auto-report through CAN a specific parameter value at the configured auto report interval (1 to 254 ms). Maximum eight registers can be configured to auto report. Use 0x3D to configure CAN auto report.

码率仅在上电时初始化。无法即时更改速度。

IMD 中的 CAN 接口实现是一个专有协议，它是 CANopen 的一个更简单的变体。但是，如果要在同一网络中实现 IMD 和 DEIF 变桨控制器或 DEIF 主控制器以外的节点，则建议使用通用协议 CANopen。

可以在配置的自动报告间隔（1 至 254 ms）通过 CAN 特定参数值将 IMD 配置为自动报告。最多可配置八个寄存器以自动报告。使用 0x3D 配置 CAN 自动报告。

7.1.2.1 Communication with charger over proprietary CAN 通过专用 CAN 与充电器通信

Always use 0x8011 command to read or write charger parameters.

Find the parameter sub object ID in section [13.3.1](#) on page [313](#).

Read from the charger:

Composing the telegram:

始终使用 0x8011 命令读取或写入充电器参数。

在第 233 页的 13.3.1 节中找到参数子对象 ID。

从充电器读取：

编写电报：

Step 步骤		Example (reading scaled current) 示例（读取标度电流）
1	Command 命令	0x8011
2	Combine with parameter index 与参数指标结合	+ 0x0200 (charger current has sub object ID 2, 00 is filer) (充电器电流有子对象 ID 2, 00 是滤波器)
3	Result 结果	0x8211
4	Build the telegram as follows:按如下方式构建电报: 3D XX YY ZZ ZZ - telegram 电报 MSB YY ----- telegram 电报 LSB XX ----- fill byte 填充字节 3D ----- Read command 读取指令	0x3D 00 11 82

Write to the charger:

Composing the telegram:

向充电器写入：

撰写电报：

Step 步骤		Example (Setting nominal voltage to 450 V) 示例（将标称电压设置为 450 V）
1	Command 命令	0x8011
2	Combine with parameter index	+ 0x1100 (Nominal voltage has sub object ID 17 = 0x11, 00 is filer)(标称电压有子对象 ID 17 = 0x11, 00

Step 步骤		Example (Setting nominal voltage to 450 V)示例 (将标称电压设置为 450 V)
	与参数索引结合	为滤波器)
3	Result 结果	0x 9111
4	Calculate voltage data (unit is 0.1 V) 计算电压数据 (单位为 0.1 V)	450*10= 4500 = 1194
4	Build the telegram as follows: 按如下方式构建电报 WW XX YY ZZ ZZ - data 数据 MSB YY ----- data 数据 LSB XX ----- telegram 电报 MSB WW ----- telegram 电报 LSB	0x 11 91 94 11

7.1.3 CANopen interface CANopen 接口

See section [13.3](#) on page [282](#) for a description and a list of parameters (CANopen objects).

有关说明和参数列表（CANopen 对象），请参阅第 215 页第 13.3 节。



Info

CANopen uses little-endian format. That means that the least significant byte is sent first and the most significant byte is sent last. For example, object ID 2098 is sent as 98 20. The same also applies to data. However, it is not the whole data field that is little-endian, but each object in the data field. Example of TPDO1 which has the following format:

信息

CANopen 使用小端格式。这意味着首先发送最低有效字节，最后发送最高有效字节。例如，对象 ID 2098 作为 98 20 发送。这同样适用于数据。但是，并不是整个数据字段都是小端格式，而是数据字段中的每个对象。具有以下格式的 TPDO1 示例：

Byte 1 字节 1	Byte 2 字节 2	Byte 3 字节 3	Byte 4 字节 4	Byte 5 字节 5	Byte 6 字节 6	Byte 7 字节 7	Byte 8 字节 8
POS-Actual (Obj. 0x206D)				POS-Actual_2 (Obj. 0x206F)			
POS-实际 (Obj. 0x206D)				POS-实际 _2(Obj. 0x206F)			

Data 数据	Interpretation 解释
7B 3C 3F 4F FF 1F 00 00	Resolver position: 4F 3F 3C 7B SSI encoder position: 00 00 1F FF 编码器位置:4F 3F 3C 7B SSI 编码器位置:00 00 1F FF

7.1.3.1 CANopen node ID CANopen 节点 ID

In CANopen the same address (Node ID) is used for both send and receive. The Node ID of each IMD is given by a value from the CAN ID switch on the IMD, and a software base Node ID, set in the IMD Manager. The switch has valid values from 0 to 14.

In the following examples, the base Node ID is given as a hexadecimal value.

在 CANopen 中，发送和接收使用相同的地址(节点 ID)。每个 IMD 的节点 ID 由 IMD 上的 CAN ID 开关和 IMD 监控软件中设置的软件基础节点 ID 给定。开关的有效值从 0 到 14。

在下面的示例中，基本节点 ID 是用十六进制值给出的。

Examples: 示例

Result 结果	Conditions 条件
Actual node ID = 1 (decimal) 实际节点 ID=1 (十进制)	CAN ID switch position = 1 Base node ID = 0x0 CAN ID 开关位置 = 1 基本节点 ID = 0x0
Actual node ID = 17 (decimal) 实际节点 ID=17 (十进制)	CAN ID switch position = 1 Base node ID = 0x10 CAN ID 开关位置 = 1 基本节点 ID = 0x10

Exceptions: 例外情况

Result 结果	Conditions 条件
<p><i>Change of CAN ID switch or base node ID while the IMD is on:</i> the existing Node ID will still be used. If the CANopen slave is reset, Node ID 127 will be used (the content of reg. 0x68 is ignored in this case).</p> <p>在 IMD 开启时更改 CAN ID 开关或基本节点 ID：仍将使用现有节点 ID。如果重置 CANopen 从站，将使用节点 ID 127（在这种情况下忽略 reg. 0x68 的内容）。</p> <p><i>At next restart*:</i> the value of reg. 0x68 will be changed to 1, and node ID 1 will be used.</p> <p>下次重启时*：reg.0x68 的值将被修改为 1，节点 ID 为 1。</p>	<p>CAN ID switch position = 0 Base node ID = 0x0 CAN ID 开关位置 = 0 基本节点 ID = 0x0</p>
<p><i>Change of CAN ID switch while the IMD is on:</i> The existing Node ID will still be used. If the CANopen slave is reset, Node ID 4 will be used.</p> <p>IMD 开启时更改 CAN ID 开关：仍将使用现有节点 ID。如果重置 CANopen 从站，将使用节点 ID 4。</p> <p><i>At next restart:</i> the content of reg. 0x68 will be automatically changed back from 1 to 0 and Node ID = base node ID + CAN ID switch will be used.</p> <p>下次重启时：reg.0x68 的内容将自动从 1 变回 0，并且将使用节</p>	<p>The content of reg. 0x68 was automatically changed from 0 to 1 at restart due to 0 value of register and CAN ID switch.</p> <p>The CAN ID switch is changed while the IMD is still on, to for example 3.</p> <p>由于寄存器和 CAN ID 开关的值为 0，reg. 0x68 的内容在重新启动时自动从 0 更改为 1。</p>

点 ID = 基本节点 ID + CAN ID 开关。

当 IMD 仍然接通时，CAN ID 开关被更改为示例 3。

Change of CAN ID switch or base node ID while the IMD is on: the existing Node ID will still be used. If the CANopen slave is reset, Node ID 127 will be used (the content of reg. 0x68 is ignored in this case).

CAN ID switch value + Base node ID >127

CAN ID 开关值+基本节点 ID>127

At next restart:* Content of reg. 0x68 will be automatically changed, so that ID switch value + Base node ID =127.

在 IMD 开启时更改 CAN ID 开关或基本节点 ID：仍将使用现有节点 ID。如果重置 CANopen 从站，将使用节点 ID 127（在这种情况下忽略 reg. 0x68 的内容）。

下次重新启动时*：reg. 0x68 的内容将自动更改，以使 ID 开关值+基本节点 ID=127。

* It is assumed that the configuration was saved to startup before restarting the IMD.

* CAN ID 开关值+基本节点 ID>127

7.1.3.2 Using Read Process Data Objects (RPDOs)使用读取过程数据对象 (RPDO)

RPDOs are used to initiate/change processes in the IMD. Four types of RPDOs are predefined and the transmission type is set to 254 (other RPDOs can be defined if needed using a CANopen manager):

RPDO 用于启动/更改 IMD 中的流程。预定义了四种类型的 RPDO，传输类型设置为 254（如果需要，可以使用 CANopen 监控软件定义其他 RPDO）：

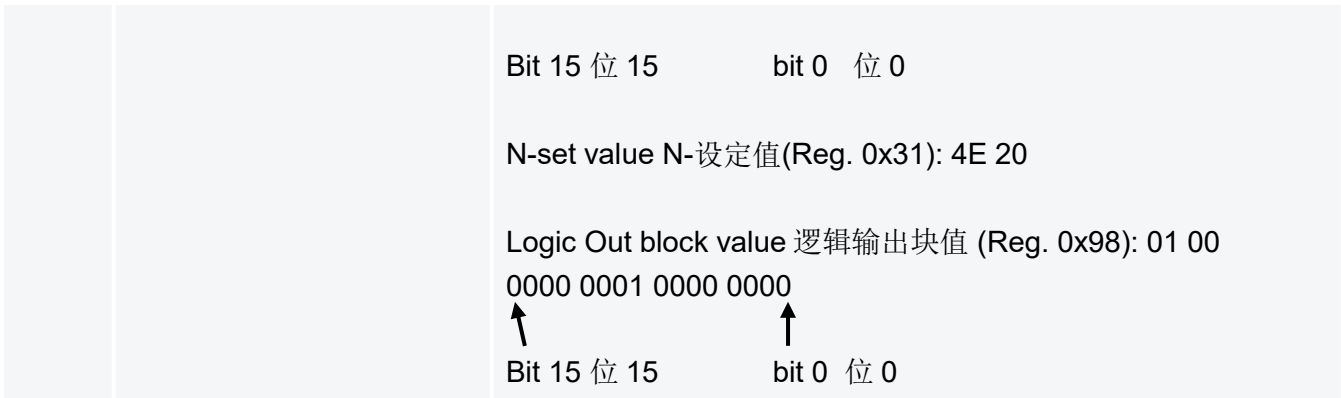


Table 12 RPDO3 – special commands

表 12 RPDO3 - 特殊命令

Used for: Executing a special command 用于: 执行特殊命令		COB ID: 0x400+Node ID COB ID: 0x400+节点 ID
Byte 1 字节 1	Byte 2 字节 2	
Special commands value 特殊命令值(Obj. 0x2003)		

Example of starting pre-heating in IMD with Node ID 2:在节点 ID 为 2 的 IMD 中启动预热的示例:

COB	Data 数据	Interpretation 解释
402	02 00	Special commands 特殊命令(Reg. 0x03): 00 02

Table 13 RPDO4 – safety run

表 13 RPDO4 - 安全运行

Used for: Initiating a safety run 用于: 启动安全运行		COB ID: 0x500+Node ID COB ID: 0x500+节点 ID
Byte 1 字节 1	Byte 2 字节 2	Any value written in byte 1 and 2 will cause the IMD to start a safety run (go to state 19, safety run setup) 在字节 1 和 2 中写入的任何值都将导致 IMD 启动安全运行 (进入状态 19, 安全运行设置)
Fun_safety run value Fun_安全运行值 (Obj. 0x2078)		

Example of initiating safety run in IMD with Node ID 3:在节点 ID 为 3 的 IMD 中启动安全运行的示例:

COB	Data 数据	Interpretation 解释
-----	---------	-------------------

503

01 00

Fun_安全运行(Reg. 0x78): 00 01

**Info**

The IMD will always execute the last sent RPDO. If a position command is sent (RPDO1) and a following speed command (RPDO2) are sent, the IMD will not stop at the position of the first PDO, but will continue with the speed and direction specified in RPDO2 that was the last sent RPDO until another RPDO is sent making it stop.

信息

IMD 将始终执行最后发送的 RPDO。如果在发送了位置命令 (RPDO1) 之后发送速度命令 (RPDO2)，IMD 将不会停在第一个 PDO 的位置，而是继续以 RPDO2 中指定的速度和方向运行，即最后发送的 RPDO，直到发送另一个 RPDO 使其停止。

7.1.3.3 Using Transmit Process Data Objects (TPDOs) 使用传输过程数据对象 (TPDO)

TPDOs are used to give feedback from the IMD to the application SW. They are sent automatically by the IMD at the configured intervals (standard interval is 1 s, which can be changed using a CANopen manager). Eight TPDOs can be configured in the IMD. Four of these are preconfigured and follow CANopen standard COB IDs:

TPDO 用于从 IMD 向应用软件提供反馈。IMD 按照配置的间隔（标准间隔为 1 秒，可使用 CANopen 监控软件进行更改）自动发送。IMD 中可以配置八个 TPDO。其中四个是预配置的，并遵循 CANopen 标准 COB ID:

Table 14 TPDO1 mapping

表 14 TPDO1 映射

Reports: Resolver Position value, SSI encoder position value 报告：编码器位置值、SSI 编码器位置值					COB ID: 180+node id 180+节点 ID		
Byte 1 字节 1	Byte 2 字节 2	Byte 3 字节 3	Byte 4 字节 4	Byte 5 字节 5	Byte 6 字节 6	Byte 7 字节 7	Byte 8 字节 8
POS-Actual (Obj. 0x206D) POS-实际 (Obj. 0x206D)				POS-Actual_2 (Obj. 0x206F) POS-实际_2 (Obj. 0x206F)			

Example: 示例

COB	Data 数据	Interpretation 解释
181	7B 3C 3F 4F FF 1F 00 00	Resolver position (Reg. 0x6D): 4F 3F 3C 7B SSI encoder position (Reg. 0x6F): 00 00 1F FF 编码器位置 (Reg. 0x6D) : 4F 3F 3C 7B SSI 编码器位置 (Reg. 0x6F) : 00 00 1F FF

Table 15 TPDO2 mapping

表 15 TPDO2 映射

Reports: Speed, current, output power, DC-link voltage 报告：速度、电流、输出功率、直流母线电压					COB ID: 280+node id 280+节点 ID		
Byte 1 字节 1	Byte 2 字节 2	Byte 3 字节 3	Byte 4 字节 4	Byte 5 字节 5	Byte 6 字节 6	Byte 7 字节 7	Byte 8 字节 8
N act (filt) (Obj. 0x20A8)		I act (filt) (Obj. 0x205F)		PowerOut 断电 (Obj. 0x20F6)		DC-link 直流母线 (Obj. 0x20EB)	

Example: 示例

COB	Data 数据	Interpretation 解释
281	4F 71 58 00 F7 02 95 3E	Speed 速度: 71 4F → 2656 RPM Current 电流: 00 58 → 8.2 A Power out 断电: 02 F7 → 759 (relative value of the output power) DC-link voltage 直流母线电压: 3E 95 → 536 V DC

Table 16 TPDO3 mapping

表 16 TPDO3 映射

Reports: General IMD status, Digital output status 报告：一般 IMD 状态、数字输出状态					COB ID: 380+node id 380+节点 ID		
Byte 1 字节 1	Byte 2 字节 2	Byte 3 字节 3	Byte 4 字节 4	Byte 5 字节 5	Byte 6 字节 6	Byte 7 字节 7	Byte 8 字节 8
Drive status 驱动器状态 (Obj. 0x2040)				Logic in block 逻辑块 (Obj. 0x209B)			

Example: 示例

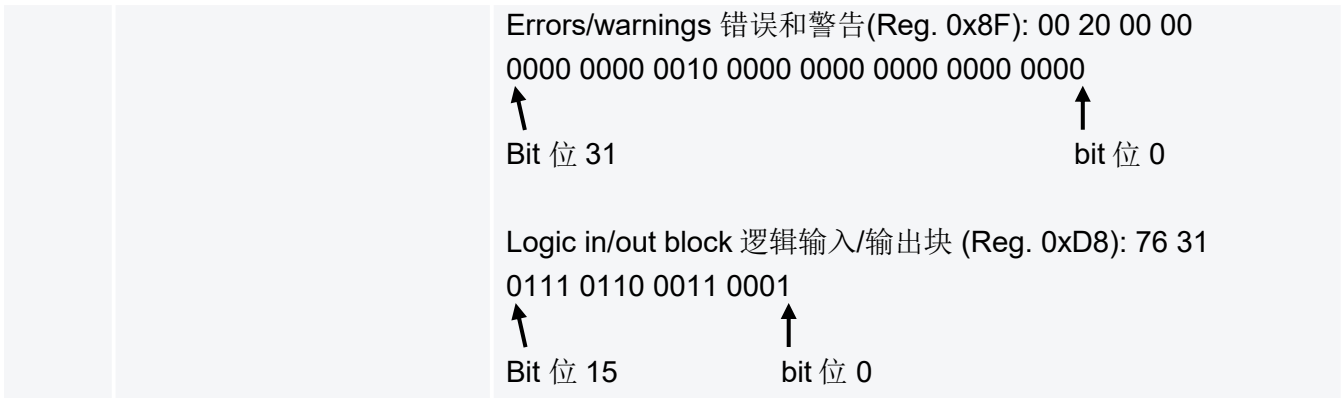
COB	Data 数据	Interpretation (see also relevant bit mapping sections) 解释 (另见相关位映射章节)
381	90 47 00 40 07 00 03 31	Drive status 驱动器状态 (Reg. 0x40): 40 00 47 90 0100 0000 0000 0000 0100 0111 1001 0000 ↑ ↑ Bit 位 31 bit 位 0 Logic out block (Reg. 0x9B): 31 03 00 07 0011 0001 0000 0011 0000 0000 0000 0111 ↑ ↑ Bit 位 31 bit 位 0

Table 17 TPDO4 mapping 表 17 TPDO4 映射

Reports: Device mode, errors and warnings, logical inputs and outputs 报告：设备模式、错误和警告、逻辑输入和输出						COB ID: 480+node id 480+节点 ID	
Byte 1 字节 1	Byte 2 字节 2	Byte 3 字节 3	Byte 4 字节 4	Byte 5 字节 5	Byte 6 字节 6	Byte 7 字节 7	Byte 8 字节 8
Device mode 设备模式 (Obj. 0x2051)		Errors/Warnings 错误和警告 (Obj. 0x208F)				Logic in/out Block 逻辑输入和输出 (Obj. 0x20D8)	

Example: 示例

COB	Data 数据	Interpretation (see also relevant bit mapping sections) 解释 (另见相关位映射章节)
481	04 00 00 00 20 00 31 76	Device mode (Reg. 0x51): 00 04 0000 0000 0000 0100 ↑ ↑ Bit 位 15 bit 位 0



7.1.3.4 Using Service Data Objects (SDOs) 使用服务数据对象 (SDO)

SDO service can be used to read data from or write data to an object in the IMD, provided the object has a CAN ID (20xx). Read or write operations might be limited depending on the access type of the specific object. The SDO server receives requests at the standard COB ID 0x600 + Node ID, and will respond at COB ID 0x580 + Node ID.

SDO 服务可用于从 IMD 中的对象读取数据或向其写入数据，前提是该对象具有 CAN ID (20xx)。根据特定对象的访问类型，读或写操作可能会受到限制。SDO 服务器以标准 COB ID 0x600+节点 ID 接收请求，并将以 COB ID 0x580+节点 ID 响应。

Read Example: 读取示例

COB	Data 数据	Interpretation (see also relevant bit mapping sections) 解释 (另见相关位映射章节)
601	40 98 20 00 00 00 00 00	Application: Read object 2098 from node with node ID 1 应用程序：从节点 ID 为 1 的节点读取对象 2098
581	4B 98 20 00 01 01 00 00	Reply from node 节点回复: 0x0101 0000 0001 0000 0001 ↑ ↑ Bit 位 15 bit 位 0

Consult the CANopen standard specification CiA-301, for detailed information on how the SDO service works, and the format of the reply SDOs.

See section 13.3 on page 282 for object IDs and data definitions.

请参阅 CANopen 标准规范 CiA-301，以获取有关 SDO 服务如何工作以及回复 SDO 格式的详细信息。有关对象 ID 和数据定义，请参阅第 215 页上的第 13.3 节。

7.1.3.5 Firmware update via CANopen implementation guidelines 通过 CANopen 实施指南进行固件更新

To initiate and perform FW upgrade through CANopen, a special SW must be developed and implemented by the customer in the Pitch Motion Controller, or the Turbine Main Controller. This section gives guidelines for the implementation of this SW.

It is expected that whoever develops this SW has knowledge of how to use and program CANopen communication. This knowledge is outside the scope of this manual.

The following tables lists the sequence of actions needs to be done to perform the FW update:

要通过 CANopen 启动和执行固件升级，客户必须在变桨控制器或风机主控制器中开发和实施特殊的软件。本节提供了实施该软件的指南。

希望开发此软件的人了解如何使用和编程 CANopen 通信。这些知识超出了本手册的范围。

下表列出了执行固件更新需要执行的操作序列：

Step 步骤	CAN Object type CAN 对象类 型	Operation 操作	To/from object 至/从对象	Write/ expected- read data 写入/预期读取 数据	Description 描述
1	SDO	Write 写	To 至 0x1F51 sub 1 (Program control) (程序控制)	0	Stop application and invoke the bootloader. if application refuses SDO_ABORT otherwise reset forced reaction SDO timeout due to no SDO response 如果应用程序拒绝 SDO_ABORT 停止应用程序并调用引导加载程 序。 否则，由于没有 SDO 响应，将重 置强制反应 SDO 超时
2	SDO	Read 读	From 从 0x1000 sub 0 (Device Type) (设备类型)	0x424F4F54	Check that the bootloader is active: 0x424F4F54: Bootloader is running 0x0: Application is running 检查引导加载程序是否处于激活状 态： 0x424F44: 引导加载程序正在运行 0x0: 应用程序正在运行
3	SDO	Write 写	To 至 0x1F51 sub 1 (Program control) (程序控制)	3	Erase the flash memory allocated to the application. Takes approximately 10 s. 抹去分配给应用程序的闪存。大约 需要 10 秒。
4	SDO	Read 读	From 从 0x1F57 sub 1 (Flash Status)	2	Read the flash status to verify that the application is deleted: 读取闪 存状态以验证应用程序是否已删

Step 步骤	CAN Object type CAN 对象类 型	Operation 操作	To/from object 至/从对象	Write/ expected- read data 写入/预期读取 数据	Description 描述
			(闪存状态)		除： 0 = Application OK 应用程序正常 1 = busy 忙碌 2 = No application in flash 闪存中 没有应用程序
5	SDO	Write domain 写域	To 至 0x1F50 sub 1 (Download Program Data) (下载程序数 据)	Transfer 传输 CoU_IMD.crc	Transfer the application file in 7 bytes blocks to the IMD. 将应用程序文件以 7 字节块的形式 传输到 IMD。
6	SDO	Read 读	From 从 0x1056 sub 1 (Application Id) (应用程序 Id)	Any value except for 0 (zero) 除 0 以外的任何 值	Check that the downloaded crc is correct. If there is any error the value will be 0.检查下载的 crc 是 否正确。如果有任何错误，该值 将为 0。
7	NMT	reset COMM 重置通信			If the value in step 6 is 0 (error), reset the communication and repeat steps 5 and 6.如果步骤 6 中的值为 0 (错误)，则重置通信 并重复步骤 5 和 6。
8	NMT	Reset NODE 重置节点			If the value in step 6 is not 0 (success), restart the IMD to start the application.如果步骤 6 中的值 不为 0 (成功)，则重新启动 IMD 以启动应用程序。
9	SDO	Read 读	From 从 0x1000 sub 0 (Device Type) 设备类型	0	Check that the application is active:检查应用程序是否处于激活 状态： 0x0: Application is running 应用程 序正在运行 0x424F4F54: Bootloader is running 引导加载程序正在运行

7.2 Serial data interface 串行数据接口

The serial data interface is implemented as a virtual com port over USB. It is mainly used for a communication with a PC running the IMD Manager for configuration or monitoring/troubleshooting purposes. The interface allows for 16 bit or 32 bit data packages. The following figures shows the format for both options.

串行数据接口是通过 USB 实现的虚拟 com 口。主要用于与运行 IMD 监控软件的 PC 机通信，进行配置或监控/故障排除。该接口允许 16 位或 32 位数据包。下图显示了这两个选项的格式。

Serial/USB 16 bit data package format 串行/USB 16 位数据包格式							Drive response to the PC 驱动器对 PC 的响应	
Sending from the PC to the drive 从 PC 发送到驱动器								
Char1	Char2	Char3	Char4	Char5	Char6	Char7	Byte1	Byte2
Reg. ID	Reg. ID	Data	Data	Data	Data	Sync	Data	Data
Bits	Bits	Bits	Bits	Bits	Bits	"X"	Bits	Bits
07..04	03..00	15..12	11..08	07..04	03..00		07..04	07..04
ascii	ascii	ascii	ascii	ascii	ascii	ascii	binary	binary

Serial/USB 32 bit data package format 串行/USB 32 位数据包格式											Drive response to the PC 驱动器对 PC 的响应				
Sending from the PC to the drive 从 PC 发送到驱动器															
Char1	Char2	Char3	Char4	Char5	Char6	Char7	Char8	Char9	Char10	Char11	Byte1	Byte2	Byte3	Byte4	
Reg. ID	Reg. ID	Data	Data	Data	Data	Data	Data	Data	Data	Sync	Data	Data	Data	Data	
Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	"X"	Bits	Bits	Bits	Bits
07..04	03..00	31..28	27..24	23..20	19..16	15..12	12..08	07..04	03..00		07..04	07..04	07..04	07..04	
ascii	ascii	ascii	ascii	ascii	ascii	ascii	ascii	ascii	ascii	ascii	binary	binary	binary	binary	

The following example shows a 16 bit format read operation from register ID 0x30, which contains the actual speed value: 以下示例显示从寄存器 ID 0x30 读取 16 位格式的操作，其中包含实际速度值：

Example of reading actual speed, 16 bit format 读取实际速度示例，16 位格式 (Return value of up to ± 32767 equals to 2 bytes)(返回值为 ± 32767 = 2 字节)							Drive response to the PC 驱动器对 PC 的响应	
Sending from the PC to the drive 从 PC 发送到驱动器								
Char1	Char2	Char3	Char4	Char5	Char6	Char7	Byte1	Byte2
Reg. ID	Reg. ID	Data	Data	Data	Data	Sync	Data	Data
Bits	Bits	Bits	Bits	Bits	Bits	"X"	Bits	Bits
07..04	03..00	15..12	11..08	07..04	03..00		07..04	07..04
3	D	0	0	3	0	X	Lo byte	Hi byte
Read register 读寄存器 (0x3D)	Actual speed value register 实际速度值寄存器 (0x30)					ascii	Value of register 0x30 寄存器 0x30 的值	

When using the IMD Manager the serial connection is plug and play.

Follow the instructions in the IMD Manager Installation instructions to install the IMD Manager.

使用 IMD 监控软件时，串行连接为即插即用。

请参考《IMD 监控软件安装说明》安装 IMD 监控软件。

8. IMD configuration IMD 配置

This section describes how to configure the IMD in a specific setup (such as motor, resolver brake and so on). When the configuration is finished and verified, it can be saved as a configuration file created for use in installation process during production. See the IMD Manager user manual for detailed information about how to use the IMD Manager.

本节介绍如何在特定设置（如电机、编码器制动器等）中配置 IMD。配置完成并验证后，可以将其保存为一个配置文件，用于生产过程中的安装。有关如何使用 IMD 监控软件的详细信息，请参阅 IMD 监控软件用户手册。



Info

If a parameter is not applicable due to another parameter setting, it will be hidden.

信息

如果某个参数由于其他参数设置而不适用，则该参数将被隐藏。

8.1 Prerequisites 先决条件

The following is needed for the configuration:配置需要以下内容:

8.1.1 Hardware 硬件

IMD connected with all the HW that is going to be used in the turbine. Some of the HW can be simulated if necessary:IMD 与风机中使用的所有硬件相连。如有必要，可以模拟某些硬件:

- Motor (with or without resolver)电机（带或不带编码器）
- Brake (if the IMD is to control the brake)制动器(如果是 IMD 控制制动器)
- Connections of digital inputs and outputs 数字量输入和输出的连接
- Protected (fused) 400 V AC. The connection must have a breaker.保护（保险丝）400 V 直流。连接必须有断路器。
- If the IMD variant used doesn't contain 24 V DC power supply, a separate 24 V DC power supply is needed as well.如果 IMD 型号不包含 24v 直流电源，也需要单独的 24v 直流电源。
- Protected (fused) batteries or ultra-caps for safe energy. The connection must have a breaker.保护（保险丝）电池或超级电容器，确保能源安全。连接必须有断路器。
- Safety-chain connections, or if safety-chain is not used, SCI inputs must be connected either as shown in [Figure 31](#) on page [63](#) or through RO relay in order to be able to reset the IMD safety-chain. If RO is used, it is possible to open and close it using the IMD Manager.安全链连接，或者如果未使用安全链，则必须按照第 51 页图 31 所示或通过 RO 继电器连接 SCI 输入，以便能够重置 IMD 安全链。如果使用 RO，则可以使用 IMD 监控软件打开和关闭 RO。
- A computer for the IMD manager connected to the "Service" connector of the IMD.
将 IMD 监控软件的计算机连接到 IMD 的“服务”连接器。
- Datasheet and specifications for motor, resolver (if used) and brake.电机、编码器(如果使用)和制动器数据表和规格。

**Info**

It is possible to configure the IMD without the accessories (motor, resolver, SSI encoder and so on) and mains. In this case 24 V DC power supply must be connected to X7. Errors will be present for the missing components, but the parameter configuration can be done. Some of the described procedures (for example resolver offset calibration) cannot be performed. The SE charger (option) cannot be configured without mains.

信息

可以在没有附件（电机、编码器、SSI 编码器等）和电源的情况下配置 IMD。在这种情况下，必须将 24 V 直流电源连接到 X7。缺少的组件会出现错误，但可以完成参数配置。无法执行所述的某些步骤（例如编码器偏移校准）。SE 充电器（可选）在没有电源的情况下无法配置。

8.1.2 Software 软件

A computer with the IMD Manager and USB driver running. See IMD Manager Installation instructions for PC requirements and SW installation instructions.

运行 IMD 监控软件和 USB 驱动程序的计算机。有关 PC 要求和软件安装说明，请参阅 IMD 监控软件安装说明。

8.2 Safety 安全

See safety precautions in section [2](#) on page [12](#). 参阅第 11 页第 2 节中的安全预防措施。

8.3 Turning the power on 打开电源

1. Follow the procedure described in section [9.15](#) on page [197](#) 1.按照第 150 页上的 9.15 节中描述的步骤进行操作
2. Configure the IMD Manager communication (See IMD Manager user manual)配置 IMD Manager 通信（参阅 IMD 监控软件用户手册）

**Attention**

Monitor the actual current during the configuration. Before the drive is configured with all parameters for the actual motor, high currents may be generated.

注意

在配置期间监控实际电流。在使用实际电机的所有参数配置驱动器之前，可能会产生高电流。

8.4 Configuring general parameters 配置一般参数

The general parameters are configured in the “Configuration 1/3” tab.通用参数在“配置 1/3”标签中配置。

8.4.1 Configuring the general servo fields 配置一般伺服域

The “Servo” fields are general configurations of the IMD. The red dashed rectangle in the following figure shows the parameters that are to be configured. “伺服”字段是 IMD 的一般配置。下图中红色虚线矩形表示需要配置的参数。

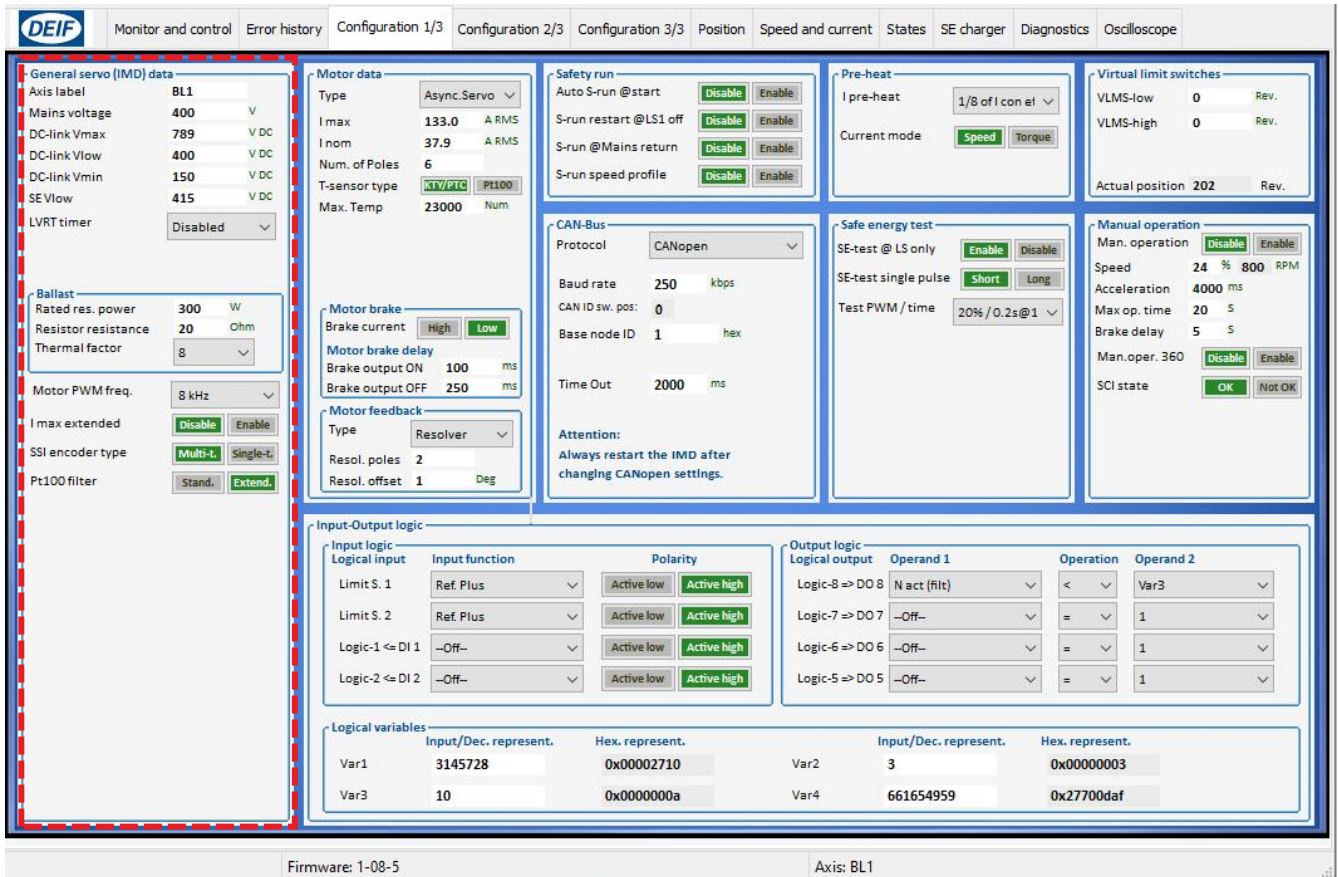
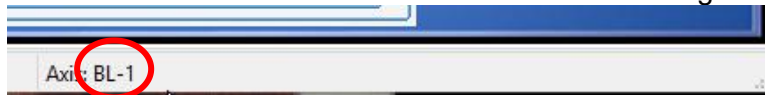


Figure 37 Servo data in IMD Manager configuration 1/3

图 37 IMD 监控软件配置 1/3 中的伺服数据

Fill in the following fields:填写以下字段:

- **Axis label:** The label is an optional parameter that can be used to differentiate between different IMDs. Up to 4 characters can be used. The label is also shown at the right bottom of the IMD



Manager as well:

轴标签: 标签是一个可选参数, 可用于区分不同的 IMD。最多可以使用 4 个字符。标签也显示在 IMD 监控软件的右下角

- **Mains:** Mains voltage. Enter the nominal voltage used.电源:电源电压。输入所使用的标称电压。

There are several thresholds (settings, errors and warnings) which are related to the voltages on the DC-link and SE voltage. These are depicted in the following figure, and described after the figure:

有几个阈值（设置、错误和警告）与母线电压和 SE 电压相关。如下图所示，并在图后进行说明：

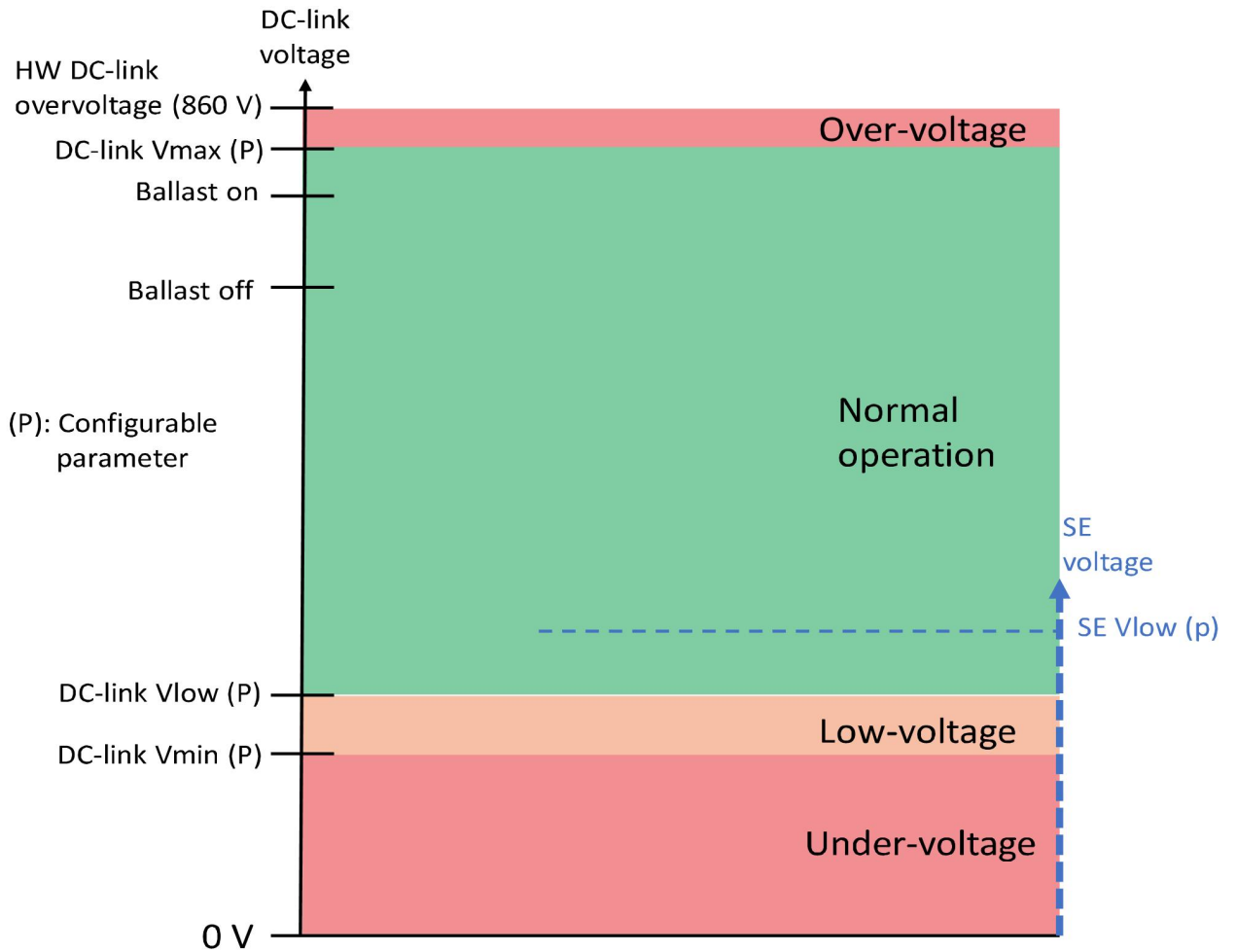


Figure 38 DC-link voltages thresholds

图 38 直流母线电压阈值

- **DC-link Vmax:** The level at which the IMD will generate an error and perform a safety run. This parameter also determines the ballast on and off thresholds, which are connected and disconnected automatically when needed according to the following:

直流母线 V max : IMD 将生成错误端执行安全运行的级别。该参数还决定了镇流器的开、关阈值，需要时自动连接和断开，按如下方式：

- **Ballast on:** $DC\text{-link voltage} > DC\text{-link Vmax} - (1/32 * DC\text{-link Vmax})$ 镇流器开启：直流母线电压 > 直流母线 V max - (1/32 * 直流母线 V max)
- **Ballast off:** $DC\text{-link voltage} < V\text{ ballast on} - (2/32 * V\text{ ballast on})$ 镇流器关闭：直流母线电压 < 镇流器开启电压 - (2/32 * 镇流器开启电压)

The ballast resistor state can be monitored by reading reg. 0xEA (0: resistor OFF, 1: resistor ON). It can be difficult to monitor the ballast resistor since the ON time of the resistor can be as short as

250 ̄s.制动电阻状态可以通过读取 reg 进行监控。0xEA（0：电阻关闭，1：电阻开启）。由于电阻的导通时间可能短至 250 秒，因此可能难以监控制动电阻。

<p>Example ballast ON:镇流器开启示例:</p> $789 - \frac{1}{32} * 789 = 765$ <p>Ballast ON when DC-link voltage is above 765 V DC 当直流母线电压高于 765 V DC 时镇流器开启</p>	<p>DC-link V max: 789 V DC 直流母线 V max ;789 V 直流</p>
<p>Example ballast OFF:镇流器关闭示例:</p> $765 - \frac{2}{32} * 765 = 717$ <p>Ballast Off when DC-link voltage is below 717 V DC 当直流母线电压低于 717 V DC 时镇流器关闭</p>	<p>DC-link V max: 789 V DC 直流母线 V max ;789 V 直流</p>

The nominal voltage of the DC-link must be considered when configuring the DC-Vmax. Determine the nominal voltage by: *nominal voltage = Mains input voltage * S2*. Typical values of DC-link maximum voltages are:

配置 DC-Vmax 时必须考虑直流母线的标称电压。

通过以下方式确定标称电压：标称电压 = 主电源输入电压 * S2。

直流母线 V max 的典型值为：

Mains voltage (tolerance) 电源电压（公差）	DC-link voltage (nominal – highest) 直流母线电压（标称 - 最高）	Recommended DC-link Vmax 推荐直流母线 V max
3 x 230 (±10 %)	325 – 358 V DC	Use default value (789 V)
3 x 400 (±10 %)	565 – 622 V DC	Use default value (789 V)
3 x 415 (±10 %)	587 – 646 V DC	Use default value (789 V)
3 x 480 (±8 %)*	679 – 735 V DC	Use value 840 V

* +8 % of 480 V AC is the maximum allowed input voltage for the IMD

* 480v AC+ 8%是 IMD 的最大允许输入电压

When configuring this parameter, the ballast resistor OFF value must have enough margin above the expected highest DC-link voltage, to ensure that the connection to the ballast resistor will be disconnected after it was connected. On the other hand, the higher the DC-link Vmax is, the higher will ballast ON and OFF be, and the higher the current / power in the ballast resistor.

When mains input values above 3x415 are used, using the default DC-link V max (789 V) will result in a ballast OFF threshold which is too close the highest case of the DC-link voltage. It is recommended to use higher values for the DC-link Vmax (see table above).

配置此参数时，制动电阻的断开值必须比预期的最高直流母线电压有足够的余量，以确保制动电阻在连接后断开连接。另一方面，直流母线 V max 越高，镇流器的接通值和断开值就越高，制动电阻中的电流/功率就越大。

当使用高于 3x415 的电源输入值时，使用默认的直流母线 V max (789 V) 将导致镇流器关闭阈值太接近直流母线电压的最高情况。建议使用更高的直流母线 V max 值(见上表)。（见上表）。

- **DC-link Vlow:** The level at which the IMD will generate UNDERVOLTAGE error, trips safety chain and performs a safety run. If Mains is disconnected from the DC-link, the IMD will attempt to reconnect the Mains.

直流母线 Vlow: IMD 将产生欠压错误、跳闸安全链并执行安全运行。如果电源与直流母线断开, IMD 将尝试重新连接电源。

- **DC-link Vmin:** The level at which the IMD will disable the drive and engage the brake. The minimum voltage value must be above 120 V DC. This parameter is used to protect the IMD output module (the current will be very high at low voltage), and the energy source from depletion. In firmware older than 1.04.0, this parameter had also the function of SE Vlow.

直流母线 Vmin: IMD 将禁用驱动器并接合制动器。最小电压值必须高于 120 V DC。此参数用于保护 IMD 输出模块（在低电压下电流将非常高）以及防止电源耗尽。在 1.04.0 之前的固件中, 此参数还具有 SE Vlow 功能。

- **SE Vlow:** The minimum allowed voltage of the safe energy. A warning is generated if the safe energy voltage is below this voltage. If the SE voltage is below SE Vlow, it is not possible to disconnect AC mains from the DC-link (see section 9.3 on page 175). However, disconnecting the AC mains is always possible if SE Vlow is set to zero. This parameter is available in firmware 1.04.0 or higher.

SE Vlow: 后备电源的最小允许电压。如果后备电源电压低于此电压, 将生成警告。如果 SE 电压低于 SE Vlow, 则无法从直流母线断开交流电源（见第 133 页第 9.3 节）。但是, 如果 SE Vlow 设置为零, 则始终可以断开交流电源。此参数在固件 1.04.0 或更高版本中可用。

- **LVRT timer:** Defines the behaviour of the IMD in low voltage situation (Low Voltage Ride through). If the Mains is not OK it is possible to configure the IMD for automatic safety run. The following values can be configured:

LVRT 定时器: 定义 IMD 在低电压情况下的行为（低电压穿越）。如果电源不正常, 可以将 IMD 配置为自动安全运行。可以配置以下值:

- **Disabled:** No safety run is performed after a mains failure 电源故障后不执行安全运行
- **5 s:** Safety run is performed 5 seconds after a mains failure 电源故障后不执行安全运行
- **10 s:** Safety run is performed 10 seconds after a mains failure 电源故障后 10 秒执行安全运行
- **15 s:** Safety run is performed 15 seconds after a mains failure 电源故障后 15 秒执行安全运行

- **Ballast group:镇流器组:**

- **Rated res. power:** The ballast resistor effect in W (default 300, equal to the standard built-in resistor in IMD 122 B and early production of 122 C). This value is used for the ballast overload error calculation.

额定功率:镇流器电阻效应, 单位为 W（默认 300, 相当于 IMD 122 B 中的标准内置电阻和早期生产的 122 C）。该值用于计算镇流器过载误差。

- **Resistor resistance:** The ballast resistor impedance in Ω . (default 20, equal to the standard built-in resistor.) Observe the requirements for the resistor in section 5.2.4 on page 43.

电阻器电阻: 镇流器电阻器阻抗, 单位为 Ω 。（默认 20, 等于标准内置电阻。）请遵守第 35 页上的 5.2.4 节中的电阻要求。

- **Thermal factor:** The thermal factor selection is set to define for the IMD, how fast the ballast resistor is able to cool down again after it has been hot. It is used for optimization of the Ballast energy overload error on one hand, and protection of the resistor on the other hand. In normal situation when the standard pre-mounted ballast resistor is used, it is recommended to select "2" (smallest factor, longest cooling time). If an external resistor with better cooling conditions is used, use a higher factor since the IMD would then be able to brake / decelerate more before generating a Ballast energy overload error.

热因子:热因子的选择被设置为 IMD 定义, 制动电阻在变热后能够再次冷却的速度。它一方面用于优化镇流器能量过载误差, 另一方面用于保护电阻器。一般情况下使用标准预装制动电阻时, 建议选择“2”(最小系数, 最长冷却时间)。如果使用具有更好冷却条件的外部电阻器, 请使用更高的系数, 因为 IMD 将能够在产生镇流器能量过载错误之前更多地进行制动/减速。

- **Motor PWM freq.:** Switching frequency of the motor output. Higher frequency will cause higher switching loss, and therefore higher heat dissipation in the IMD. Note that motors are specified for minimum switching frequency in order to reach their maximum specified torque. It is recommended to use lowest allowable switching frequency (for the motor) to reduce switching losses.

Configuring the PWM frequency to 12 kHz automatically derates the maximum peak current (I max pk, reg. 0xC4) and Maximum continues current (I Con eff, reg. 0xC5) to 85% of maximum value.

电机 PWM 频率: 电机输出的开关频率。更高的频率将导致更高的开关损耗, 因此 IMD 中的散热更高。请注意, 为达到其最大规定扭矩, 电机规定了最小开关频率。建议使用允许的最低开关频率(用于电机)以减少开关损耗。

将 PWM 频率配置为 12 kHz 会自动将最大峰值电流 (I max pk, reg. 0xC4) 和最大持续电流 (I Con eff, reg. 0xC5) 降额至最大值的 85%。



Info

Changing the PWM to 12 kHz will take effect on I max pk and I Con eff immediately, but will not be shown in the respective fields in “Configuration 2/3” before the parameters are reloaded or a new value is entered.

信息

将 PWM 更改为 12 kHz 将立即对 I max pk 和 I Con eff 生效, 但在重新加载参数或输入新值之前不会显示在“配置 2/3”的相应字段中。

- **I max extended:** this parameter affects I max pk (reg. 0xC4) and T-peak (0xF0) in the “Current parameters” group in the “Configuration 2/3” tab. I max extended:

该参数影响“配置 2/3”选项卡中“Current parameters”组中的 I max pk (reg. 0xC4) 和 T-peak (0xF0)。

I max extended I max 扩展	I max pk (reg. 0xC4)	T-peak (0xF0)
Disable 禁用	Maximum value is 100 %. See also Motor PWM frequency parameter. 最大值为 100%。参阅电机 PWM 频率参数。	Maximum 6 s 最大 6 s
Enable 启用	Maximum value is 115 % See also Motor PWM frequency parameter 最大值为 115%。参阅电机 PWM 频率参数	If I max pk is set to above 100, the maximum value is 3 s. If the value of T-peak was above 3 s when I max pk is set to above 100, T-peak is automatically reduced to 3 (s). 如果 I max pk 设置为大于 100, 则最大值为 3 s。当 I max pk 设置为大于 100 时, 如果 T-peak 的值大于 3 s, 则 T-peak 会自动减小为 3 (s)。

- SSI encoder type:** The IMD has an interface towards an absolute SSI encoder that can be used to determine the absolute position of the blade. Both single-turn and multi-turn can be used. Data transmission: Only single transmission is supported. Multiple transmission (repeat of the sent data) is not supported.

Multi-turn: Only 12+12 (12 bits resolution [4096] per revolution + 12 bits number of revolutions [4096]) format is supported. Special bit can be sent from the encoder, but it will be discarded by the IMD. Gray code data format is automatically configured when configuring the SSI type to multi-turn.

Single-turn: Only 12+1 (12 bits resolution [4096] per revolution + 1 special bit) format is supported. Binary data format is automatically configured when configuring the SSI type to single-turn.

SSI 编码器类型：IMD 具有连接绝对 SSI 编码器的接口，可用于确定叶片的绝对位置。单圈和多圈都可以使用。

数据传输：仅支持单次传输。不支持多次传输（重复发送的数据）。

多圈：仅支持 12+12（每转 12 位分辨率 [4096] + 12 位转数 [4096]）格式。特殊位可以从编码器发送，但会被 IMD 丢弃。将 SSI 类型配置为多圈时，会自动配置格雷码数据格式。

单圈：仅支持 12+1（每转 12 位分辨率 [4096] + 1 个特殊位）格式。将 SSI 类型配置为单圈时，会自动配置二进制数据格式。

- Pt100 filter:** The Pt100 inputs are multiplexed by the measuring circuit. The multiplexing cycle time can be prolonged from 40 ms to 80 ms by changing the filter from “Stand.” to “Extend.”. Extended option is intended in high EMI environment.

Pt100 滤波器：Pt100 输入由测量电路多路复用。通过将滤波器从 “Stand.” 更改为 “Extend.”，复用周期时间可从 40 ms 延长至 80 ms。扩展选项适用于高 EMI 环境。

- Char.err.trip S-chain:** The behaviour of the IMD when the built-in charger reports an error. Disabled: The charger error is shown as a warning. Enabled: The charger error is shown as a warning. 10 seconds after the warning is generated the warning is escalated to an error, the safety chain is tripped and a safety run is performed. If a “Clear errors” command is sent before 10 s are passed, the timer is reset. If the reason for the error is still present, the timer starts again.

Char.err.trip S-chain：内置充电器报告错误时 IMD 的行为。

禁用：充电器错误显示为警告。

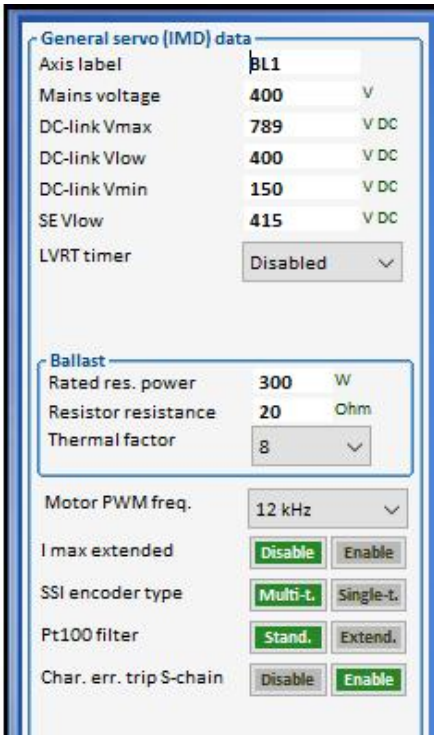
已启用：充电器错误显示为警告。警告生成 10 秒后，警告升级为错误，安全链跳闸并执行安全运行。如果在 10 秒过去之前发送了“清除错误”命令，则计时器将重置。如果错误原因仍然存在

8.4.1.1 Example of Servo configuration 伺服配置示例

The following example show configuration when five ultra-cap modules of 90 V DC are used as safe energy, and 3 x 400 V AC is used as the mains input. 以下示例显示了使用 5 个 90 V DC 超级电容模块作为后备电源，并使用 3 x 400 V AC 作为电源输入时的配置。

Parameter 参数	Value 值	Description 描述
Axis label 轴标	BL-1	Identifying name for the IMD. Here BL(ade)-1 is used. IMD 的标识名称。这里使用 BL(ade)-1。
Mains voltage 电源电压	400	Standard 3 x 400 V AC is used 标准使用 3 × 400v AC
DC-link Vmax	789	Default DC-link Vmax is used since the mains voltage is not

Parameter 参数	Value 值	Description 描述
直流母线 Vmax		above 440 V AC. 由于电源电压不高于 440V AC，因此使用默认直流母线 Vmax。
DC-link Vlow 直流母线 Vlow	300	If the DC-link voltage is down to 300 V DC, it means that the ultra-caps are also at 300 V DC which is far under their nominal 450 V DC. Therefore, a safety run should be started, and the mains connected if it is disconnected. 如果直流母线电压降至 300v DC，则意味着超级电容也处于 300v DC，远低于其标称的 450v DC。因此，应启动安全运行，如果断开电源，则接通电源。
DC-link Vmin 直流母线 Vmin	150	The ultra-cap modules can tolerate depletion to a comparatively low point. Under this voltage, output current will be too high, and for IMDs with internal power supply, a risk that the power supply will shut down. 超级电容模块可以承受相对较低的耗尽。在此电压下，输出电流会过高，对于内置电源的 IMD，存在电源关闭的风险。
SE Vlow	400	This threshold is used to give a warning that something in the safe energy system is not as it is supposed to be (under normal circumstances). 该阈值用于警告后备电源系统中的某些内容与预期不同（在正常情况下）。
LVRT timer 低穿定时器	Disabled 禁用	No automatic safety run is performed after a mains failure 电源故障后不会执行自动安全运行
Ballast-P 镇流器-P	300	The standard built-in ballast resistor is used. 使用标准内置制动电阻。
Ballast-R 镇流器-R	20	The standard built-in ballast resistor is used. 使用标准内置制动电阻。
Motor PWM frequency 电机 PWM 频率	4 kHz	4 kHz is selected in order to minimize switching losses 选择 4 kHz 以最小化开关损耗
I max extended I max 扩展	Disable 禁用	There is no need for the extra current 不需要额外电流
SSI encoder type SSI 编码器类型	Multi-t.	Multi-turn encoder is used 采用多圈编码器
Pt100 filter Pt100 滤波器	Stand.	No extra cycle time is needed 不需要额外的循环时间
Char. err. trip S-chain	Enable 禁用	Charger error will be escalated to IMD error after Charger timeout, causing safety-chain trip and safety run. 充电器超时后，充电器错误将升级为 IMD 错误，导致安全链跳闸和安全运行。



The following example show configuration when 24 x 12 V DC batteries are used as safe energy, and 3 x 400 V AC is used as the mains input.

以下示例显示了使用 24 x 12 V DC 电池作为后备电源，并且使用 3 x 400 V AC 作为电源输入时的配置。

Parameter 参数	Value 值	Description 描述
Axis label 轴标	BL-1	Identifying name for the IMD. Here BL(ade)-1 is used. IMD 的标识名称。这里使用 BL(ade)-1。
Mains voltage 电源电压	400	Standard 3 x 400 V AC is used 使用标准 3 x 400 V AC
DC-link Vmax 直流母线 Vmax	789	Default DC-link Vmax is used since the mains voltage is not above 440 V AC. 由于电源电压不高于 440 V AC，因此使用默认直流母线 Vmax。
DC-link Vlow 直流母线 Vlow	260	If the DC-link voltage is down to 260 V DC, it means that the batteries are also at 260 V DC which is far under their nominal 288 V DC. Therefore, a safety run should be started, and the mains connected if it is disconnected. 如果直流母线电压降至 260v DC，则意味着电池也处于 260v DC，远低于其标称的 288v DC。因此，应启动安全运行，如果断开电源，则接通电源。
DC-link Vmin 直流母线 Vmin	200	Batteries cannot tolerate depletion to a low voltage. Under this voltage output current will be high, and for IMDs with internal power supply, a risk that the power supply will shut down. 电池不能承受低电压的耗竭。在这种电压下，输出电流会很高，对于内置电源的 IMD，存在电源关闭的风险。
SE Vlow	288	This threshold is used to give a warning that something in the

Parameter 参数	Value 值	Description 描述
		safe energy system is not as it is supposed to be (under normal circumstances). 该阈值用于警告后备电源系统中的某些内容与预期不同（在正常情况下）。
LVRT timer 低穿定时器	10 s	Safety run is performed automatically 10 seconds after the Mains is not OK, unless there is controller intervention or mains return.除非控制器干预或电源返回，否则在主电源故障 10 秒后自动执行安全运行。
Ballast-P 镇流器-P	300	The standard built-in ballast resistor is used. 使用标准内置制动电阻器。
Ballast-R 镇流器-R	20	The standard built-in ballast resistor is used. 使用标准内置制动电阻器。
Motor PWM frequency 电机 PWM 频率	4 kHz	4 kHz is selected in order to minimize switching losses 选择 4 kHz 以最小化开关损耗
I max extended I max 扩展	Disable 禁用	There is no need for the extra current 不需要额外电流
SSI encoder type SSI 编码器类型	Multi-t.	Multi-turn encoder is used 采用多圈编码器
Pt100 filter Pt100 滤波器	Stand.	No extra cycle time is needed 不需要额外的循环时间
Char. err. trip S-chain	Enable 禁用	Charger error will be escalated to IMD error after Charger timeout, causing safety-chain trip and safety run. 充电器超时后，充电器错误将升级为 IMD 错误，导致安全链跳闸和安全运行。

General servo (IMD) data

Axis label	BL-1	
Mains voltage	400	V
DC-link Vmax	789	V DC
DC-link Vlow	260	V DC
DC-link Vmin	200	V DC
SE Vlow	288	V DC
LVRT timer	10 s	▼

Ballast

Rated res. power	300	W
Resistor resistance	20	Ohm
Thermal factor	8	▼

Motor PWM freq. 4 kHz ▼

I max extended

SSI encoder type

Pt100 filter

Char. err. trip S-chain

8.4.2 Configuring motor data 配置电机数据

Configure the motor data according to the data in the motor datasheet/specifications in the “Configuration 1/3” tab. The red dashed rectangle shows the parameters that are to be configured.

根据“配置 1/3”选项卡中电机数据表/规格中的数据配置电机数据。红色虚线矩形内显示要配置的参数。

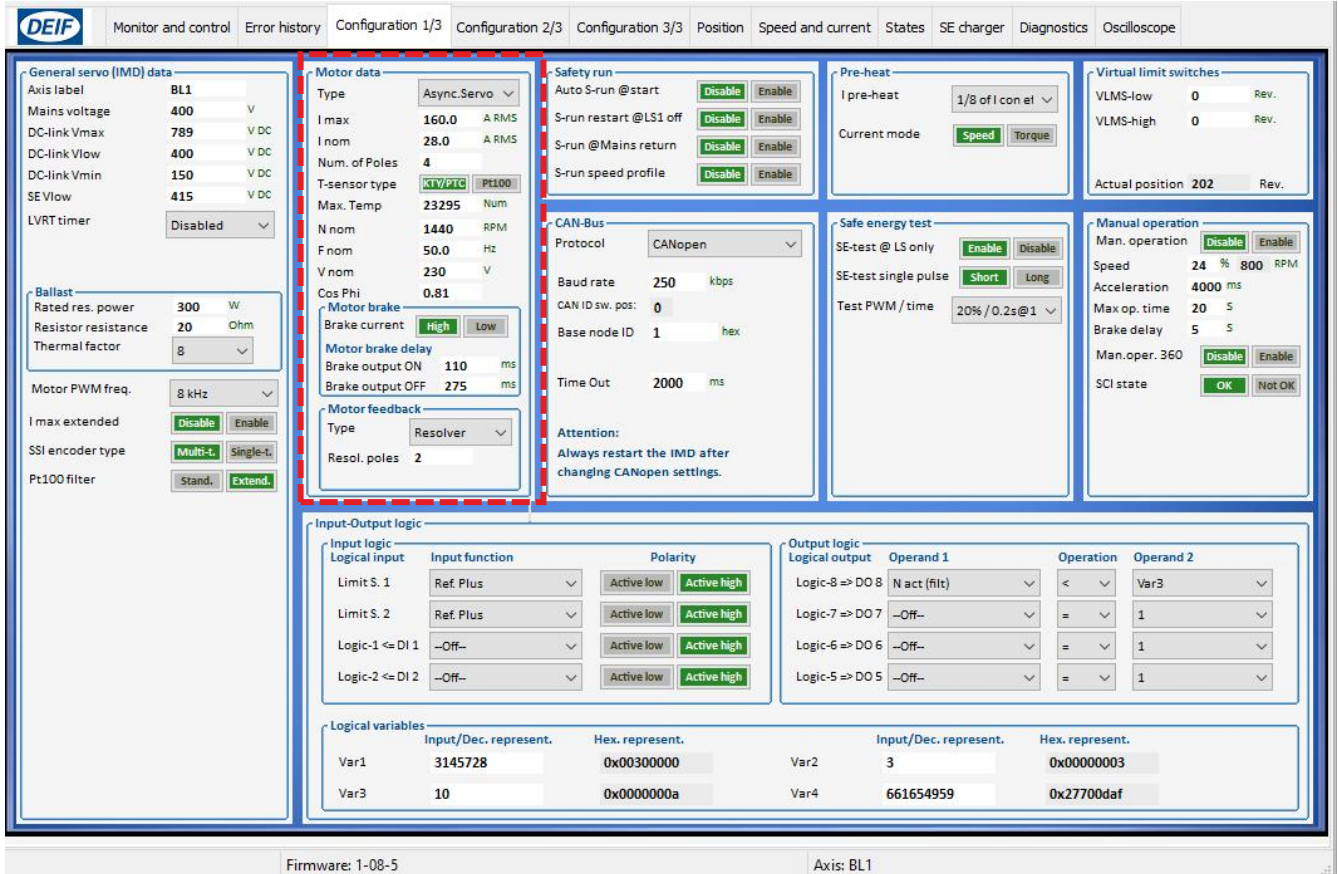


Figure 39 Motor data in IMD Manager configuration 1/3

图 39 IMD 监控软件配置 1/3 中的电机数据

NOTE The shown figure above shows the parameters when Asynchronous servo motor is selected as the motor type. Not all parameters are available is other motor types are selected.

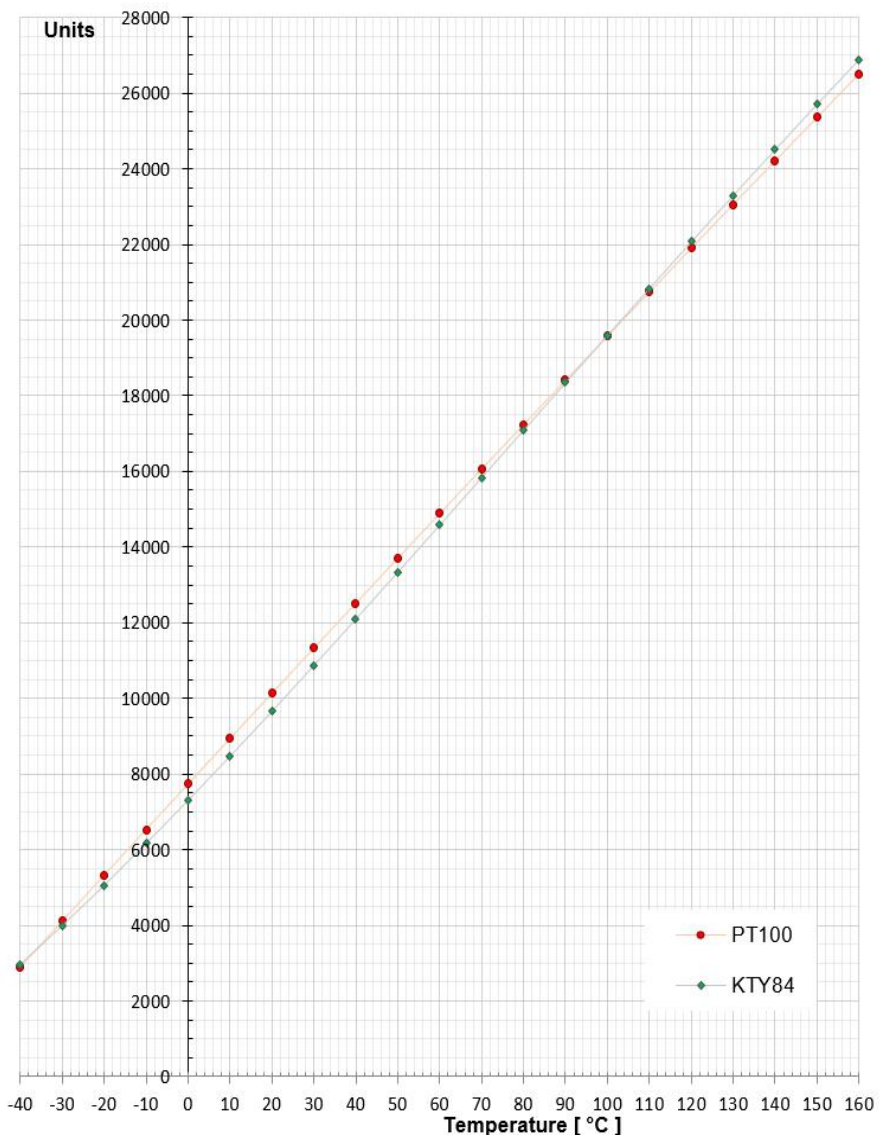
注：上图显示了选择异步伺服电机作为电机类型时的参数。如果选择了其他电机类型，则并非所有参数都可用。

Parameters:参数:

- **Type:** Select one of the following options in the dropdown list 类型：在下拉列表中选择以下选项之一
 - Sync. Servo: Permanent magnet synchronous motor with feedback (resolver)同步.伺服：带反馈的永磁同步电机（编码器）
 - Async.V/F: AC induction motor, voltage frequency controlled, with no feedback 异步.V/F：交流感应电机，电压频率控制，无反馈
 - Async. Servo: Servo asynchronous motor with feedback (resolver)异步. 伺服：带反馈的伺服异步电机（编码器）

- **I max:** Maximum motor current – the value is given as RMS 最大电机电流 – 该值以 RMS 形式给出
- **I nom:** Nominal continues motor current – the value is given in RMS 标称持续电机电流 – 该值以 RMS 形式给出
- **Num. of poles:** Number of poles in the motor (often called 2p)极数：电机中的极数（通常称为 2p）
- **T-sensor type:** Select whether the built-in temperature sensor is KTY 84/PTC or Pt100.T 型传感器类型：选择内置温度传感器是 KTY 84/PTC 还是 Pt100。
- **Max. Temp:** Maximum allowed motor temperature based on either KTY84/PTC or Pt100 sensor which is selected in 0x01. The temperature is given in number units, which can be derived from the following table (for a more precise formula see section 10.3.2 on page 229 (KTY 84) or section 10.3.3 on page 233 (Pt100)) :最高温度：基于在 0x01 中选择的 KTY84/PTC 或 Pt100 传感器的最大允许电机温度。温度以数字单位表示，可从下表中得出（更精确的公式见第 176 页第 10.3.2 节（KTY 84）或第 180 页第 10.3.3 节（Pt100））

Temp. 温度 (°C)	Units 单位 KTY 84	Units 单位 Pt100
-40	2968	2897
-30	3993	4112
-20	5060	5324
-10	6164	6531
0	7301	7735
10	8467	8935
20	9657	10132
30	10868	11325
40	12094	12514
50	13332	13700
60	14579	14883
70	15832	16061
80	17086	17237
90	18340	18409
100	19590	19577
110	20834	20741
120	22070	21903
130	23295	23060
140	24508	24214
150	25707	25365



Temp. 温度 (°C)	Units 单位 KTY 84	Units 单位 Pt100
160	26891	26512

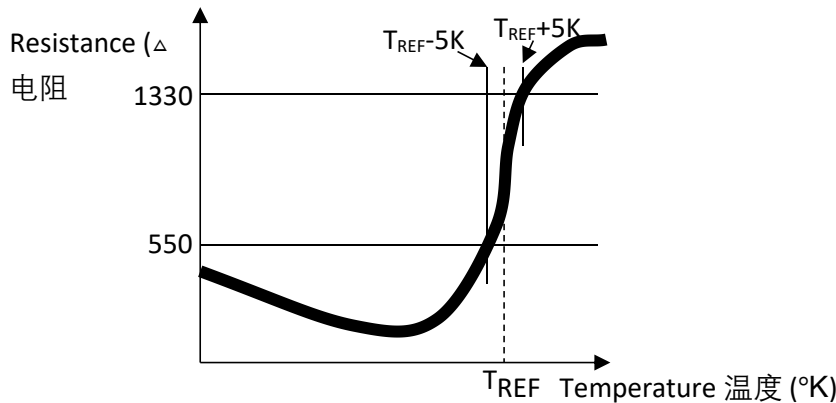
See description of function in IMD 100 function description.

参见 IMD 100 功能概述中的说明。

Special considerations when PTC is used:使用 PTC 时的特殊注意事项:

PTC is a nonlinear sensor. While a MOTORTEMP warning will still be active at 87.5% of max motor temp, it will most likely come at the same time as the MOTORTEMP error. The PTC typical resistance characteristics are depicted in the following figure:

PTC 是一种非线性传感器。虽然 MOTORTEMP 警告仍将在 87.5% 的最大电机温度下激活，但它很可能与 MOTORTEMP 错误同时出现。PTC 典型电阻特性如下图所示：



It is the PTC Tref (also called Tn) that is the decisive factor for the triggering of the MOTORTEMP error. Typically, PTC according to DIN 44081/82 or IEC60034-11:2004 is used, which means that there are three PTCs in series, one in each winding. When configuring the maximum temperature for the motor, it is imperative that the threshold is not below the resistance in minimum temperature, which might result in a MOTORTEMP error if the weather is extremely cold and the motor was not running for a while. It is recommended to configure the maximum temperature to the following (assuming the T_{REF}-5K ≈ 550Ω):

1 PTC: Configure the Max. Temp to 9300 (corresponding to 550Ω)

3 PTCs: Configure the Max. Temp to 30950 (corresponding to 1650Ω)

PTC Tref (也称为 Tn) 是触发 MOTORTEMP 错误的决定性因素。通常，使用符合 DIN 44081/82 或 IEC60034-11:2004 的 PTC，这意味着有三个 PTC 串联，每个绕组一个。在配置电机最高温度时，必须保证阈值不低于最低温度电阻，如果天气极冷且电机有一段时间没有运行，可能会导致 MOTORTEMP 错误。建议将最高温度配置为以下（假设 T_{REF}-5K ≈ 550Ω）：

1 个 PTC：将最高温度配置为 9300（对应于 550Ω）

3 个 PTC：将最高温度配置为 30950（对应于 1650Ω）

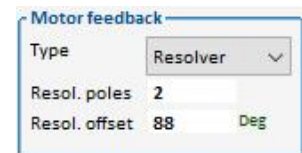
- **Brake current:** Select High or Low depending on the brake current. The detection (Brake OK flag) and protection of the brake output circuit is adjusted to higher current. 制动电流：根据制动电流选择高或低。制动器输出电路的检测（制动器正常标志）和保护调整为更高电流。
- **Motor brake delay:** 电机制动延迟：

- **Brake output ON:** The time needed from when the brake output is ON (activated) until the brake is disengaged (released). See section [6.4.2](#) on page [83](#) for details. Manufacturers often gives the time from 100% brake power to 1 or 10% brake power. In such case or if in doubt it is recommended to add some delay to ensure that that the brake is fully disengaged before starting with motor movement. (制动输出接通)：从制动输出接通(激活)到制动器分离(释放)所需的时间。详见第 65 页第 6.4.2 节。制造商通常给出从 100%制动功率到 1%或 10%制动功率的时间。在这种情况下，或者如果有疑问，建议增加一些延迟时间，以确保在启动电机运动之前制动器完全分离。
- **Brake output OFF:** The time needed from when the brake output is OFF (deactivated) until the brake is fully engaged with 100% efficiency. Do not use a value higher than 1000 ms. The IMD will stop modulation after approximately 1 s if the value is 1000 or higher and only the brake will be used to stop the motor. See section [6.4.1](#) on page [81](#) for details. . Manufacturers often gives the time from 0% brake power to 90% brake power. In such case or if in doubt it is recommended to add some delay to ensure that that the brake is fully engaged before stopping the modulation. 制动输出关闭：从制动输出关闭(停用)到制动器以 100%效率完全接合所需的时间。不要使用高于 1000 毫秒的值。如果该值为 1000 或更高，IMD 将在大约 1 秒后停止调制，并且仅使用制动器停止电机。详见第 64 页第 6.4.1 节。制造商通常给出从 0%制动功率到 90%制动功率的时间。在这种情况下或如果有疑问，建议增加一些延迟时间，以确保制动器在停止调制前完全接合。

NOTE The brake release and brake engage times are different depending on the brake. In some brakes the release time is shorter than the brake time, while in others it is the opposite.

注意：制动器释放和制动器接合时间因制动器而异。在一些制动器中，释放时间比制动时间短，而在另一些制动器中，则相反。

- **N nom:** Nominal motor speed in revolutions per minute (RPM) – not used if Sync. Servo is selected as motor type.以每分钟转数 (RPM) 为单位的标称电机速度 - 如果同步则不使用。电机类型选择伺服。
- **F nom:** Nominal motor frequency – not used if Sync. Servo is selected as motor type.标称电机频率 - 如果同步则不使用。电机类型选择伺服。
- **V nom:** Nominal motor voltage – not used if Sync. Servo is selected as motor type.标称电机电压 - 如果同步则不使用。电机类型选择伺服。
- **Cos Phi:** The cosine value of the motor – not used if Sync. Servo is selected as motor type.电机的余弦值——如果同步则不使用。电机类型选择伺服。
- **Feedback:** Select the feedback method in the dropdown list. Only “Resolver” is supported as feedback method. If no resolver is used (motor type is Async.V/f), select “SLS” (sensor-less).反馈：在下拉列表框中选择反馈方式。仅支持“编码器”作为反馈方法。如果不使用编码器(电机类型为异步.V/f)，请选择“SLS”(无传感器)。
- **Resol. poles:** The number of poles in the resolver – not used if “SLS” is selected as feedback. 极数：编码器中的极数——如果选择“SLS”作为反馈，则不使用。
- **Resol. Offset:** Offset of the resolver. Only applicable for synchronous motor with resolver (Motor type “Sync. Servo”). Cannot be configured at this point. The configuration is done later (see section [8.6.1](#) on page [152](#)). 偏移量：编码器的偏移量。仅适用于带编码器的同步电机(电机类型位“同步伺服”)。此时无法配置。配置稍后完成(请参阅第 116 页上的 8.6.1 节)。



8.4.2.1 Motor configuration example 电机配置示例

Following are examples of motor data configuration. Getting the correct values requires a combination of the motor name plate (identification plate) and the data sheet. Deciphering the name plate often requires data from the data sheet, after which it is possible to go back to the data sheet and retrieve the correct values. Some values may need extra calculation with the available data.

以下是电机数据配置的示例。获得正确的值需要结合电机铭牌（识别牌）和数据表。破译铭牌通常需要数据表中的数据，之后可以返回数据表并检索正确的值。某些值可能需要使用可用数据进行额外计算。

Synchronous servo motor example:

The following data is needed:

I nom, I max, Number of poles (motor), temperature sensor type, maximum temperature, Brake delay, number of poles (resolver).

The following figure shows the needed data collected in different parts of the data sheet and the name plate.

Motor name plate:

同步伺服电机示例:

需要以下数据:

I nom、I max、极数（电机）、温度传感器类型、最高温度、制动延迟、极数（编码器）。

下图显示了在数据表和铭牌的不同部分收集的所需数据。

电机铭牌:



Data sheet:数据表

Technical data 技术数据												
Number of Poles 级数		6	Braking torque 制动扭矩 (Nm)	≥ 143								
Rated Power 额定功率	kw	15.1	Brake closing time (ms) 制动关闭时间	60								
Rated Voltage 额定电压	VAC	400	Brake release time (ms) 制动释放时间	450								
Voltage Constant 电压常数	mV*min	150	Brake excitation current DC (A) 制动励磁直流电流(A)	1.8								
Rated Speed 额定速度	1/min	2000	Brake excitation voltage DC (V) 制动励磁直流电压 (V)	24 (+5% , -10%)								
Stall Torque 失速扭矩	Nm	94	Signal Connection									
Rated Torque 额定扭矩	Nm	72	S2	S4	PT100+	PT100-	R2	KTY84+	KTY84-	R1	S1	S3
Torque Constant 扭矩常数	Nm/A	2.4	1	2	3	4	7	8	9	10	11	12

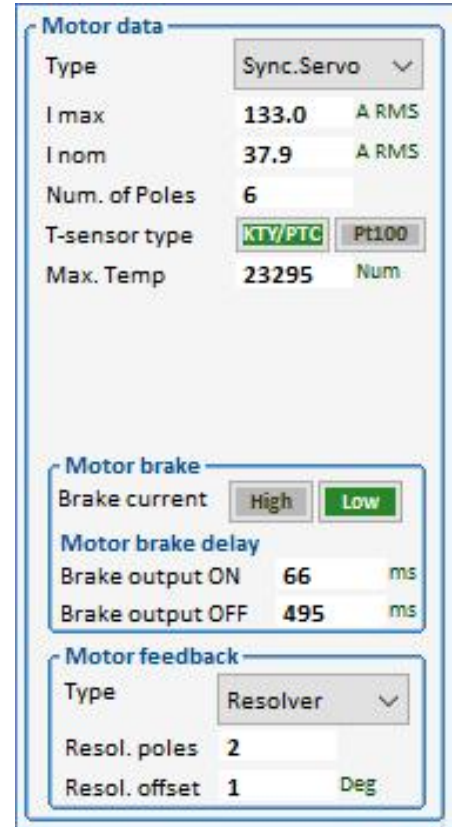


Stall Current 失速电流	A	49.5
Rated Current 额定电流	Arms	37.9
Peak Current 峰值电流	Apk	188

Table 18 Motor data for configuration:

表 18 配置电机数据:

Motor data 电机数据	Value 值	Comments 注解
I max	133	188 Apk equals 133 Arms 188 Apk 等于 133 Arms
I nom	37.9	Rated current 额定电流
Num. of Poles 极数	6	Number of motor poles 电机极数
Temperature sensor type 温度传感器类型	KTY/PTC	KTY 84 is shown in the signal connector, and used in the actual system. KTY 84 显示在信号连接器中，并在实际系统中使用。
Maximum temperature 最高温度	23295	Insulation class F: $40^{\circ} + 105^{\circ} = 145$. Extra 15° margin is added: $130^{\circ} = 23295$ according to section 10.3.2.2 on page 231. (Data for KTY 84 conversion is used.) 绝缘等级 F: $40^{\circ} + 105^{\circ} = 145$ 。根据第 178 页上的 10.3.2.2 节，添加了额外的 15° 裕度: $130^{\circ} = 23295$ 。(使用 KTY 84 转换数据。)
Brake current 制动电流	Low	The brake current is 1.8 A, which is considered low 制动电流为 1.8 A，属于低电流
Brake output ON delay 制动输出开启延时	495	Break release time. The release range is not specified, and therefore 10% is added to 450. 中断释放时间。未指定释放范围，因此将 450 添加 10%。
Brake output OFF delay 制动输出关闭延迟	66	Break closing time. The closing range is not specified, and therefore 10% is added to 60. 中断关闭时间。关闭范围没有指定，因此将 60 添加 10%。
Number of resolver poles 编码器极数	2	1 pair = 2 poles 1 对=2 极



Asynchronous servo motor example:

The following data is needed:

N nom, F nom, V nom, Cos Phi, I nom, I max, Number of poles (motor), temperature sensor type, maximum temperature, Brake delay, number of poles (resolver).

The following figure shows the needed data collected in different parts of the data sheet and the name plate.

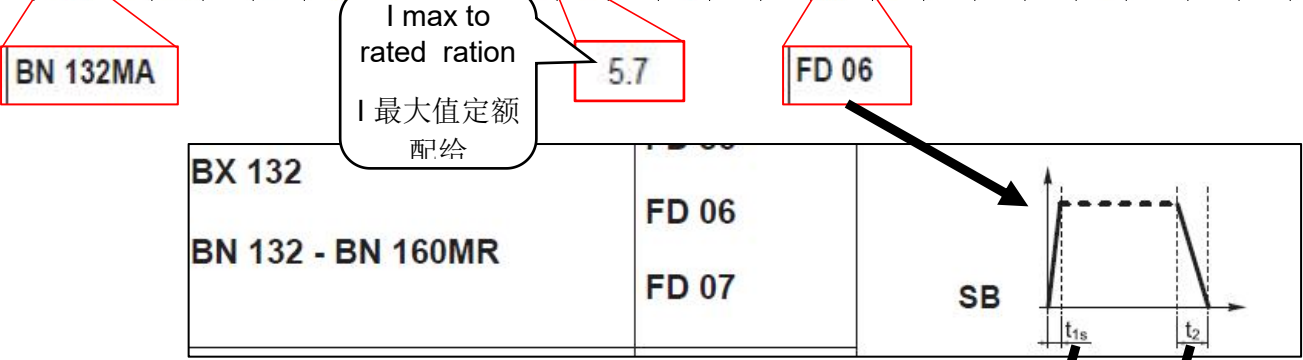
异步伺服电机示例:

需要以下数据:

N nom、F nom、V nom、Cos Phi、I nom、I max、极数（电机）、温度传感器类型、最高温度、制动延迟、极数（编码器）。

下图显示了在数据表和铭牌的不同部分收集的所需数据。

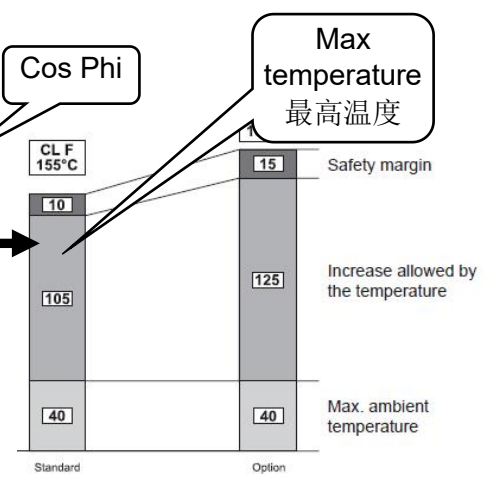
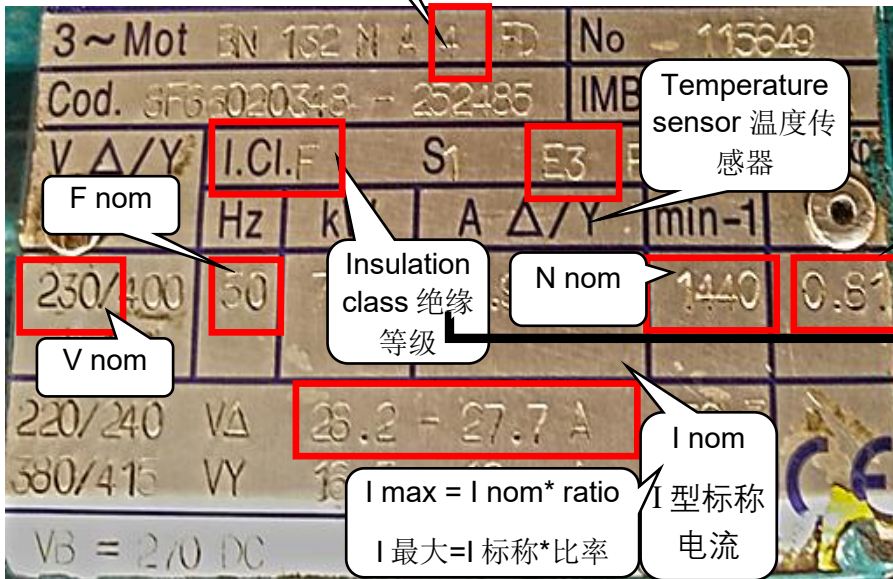
P _n kW	n min ⁻¹	M _n Nm	IE1	η (100%) %	η (75%) %	η (50%) %	cosφ	I _n 400V A	I _s I _n	M _s M _n	M _a M _n	J _m x 10 ⁻⁴ kgm ²	IM B5 kg	d.c. brake					a.c. brake							
														FD		Z ₀ 1/h			J _m x 10 ⁻⁴ kgm ²		IM B5 kg		FA			
														Mod	M _b Nm	NB	SB	J _m x 10 ⁻⁴ kgm ²	IM B5 kg	Mod	M _b Nm	Z ₀ 1/h	J _m x 10 ⁻⁴ kgm ²	IM B5 kg		
4	BN 112M	4	1430	27	•	84.4	84.2	81.6	0.81	8.4	5.6	2.7	2.5	98	30	FD 06S	60	—	1400	107	40	FA 06S	60	2100	107	42
5.5	BN 132S	4	1440	36	•	84.7	84.8	82.5	0.81	11.6	5.5	2.3	2.2	213	44	FD 56	75	—	1050	223	57	FA 06	75	1200	223	58
7.5	BN 132MA	4	1440	50	•	86.0	86.0	83.0	0.81	15.5	5.7	2.5	2.4	270	53	FD 06	100	—	950	280	66	FA 07	100	1000	280	71



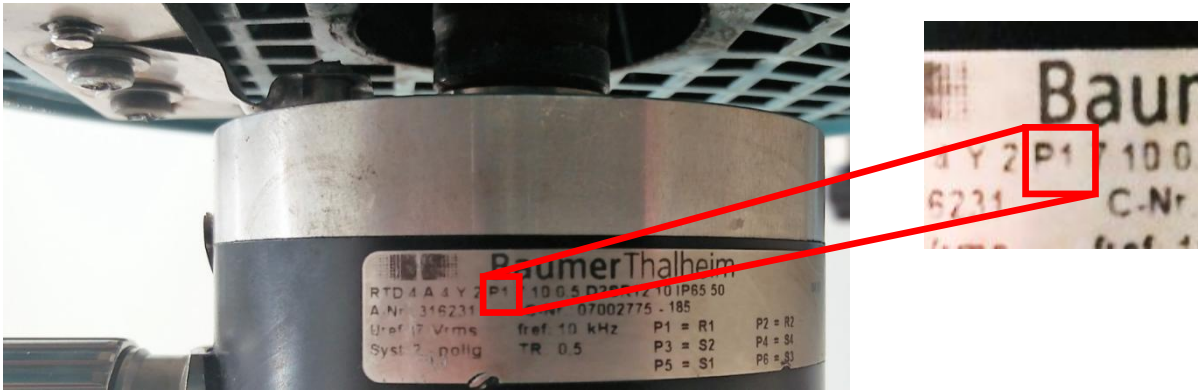
Number of Poles 极数

Brake delay 制动延迟

Brake power consumption 制动功率消耗



The resolver in this example is an external resolver:本例中的编码器是一个外部编码器:



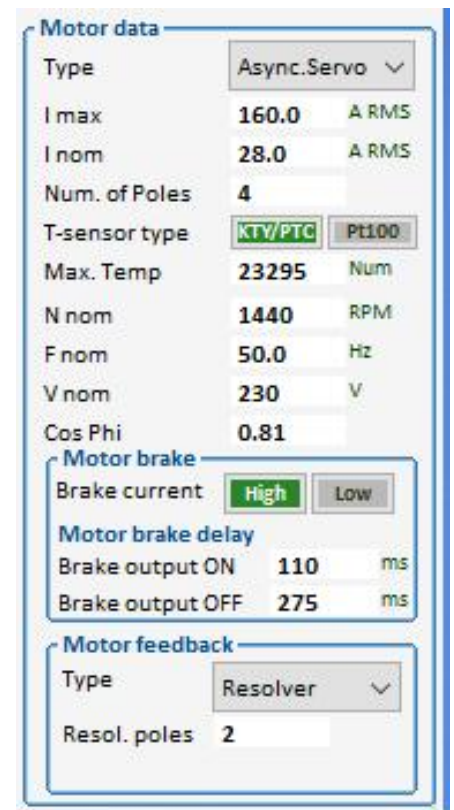
According to Baumer’s data sheet “P1” in the type number indicates the number of pole pairs: 1 pole pair = 2 poles.

根据 Baumer 的数据表 “P1” 中的类型数表示极对的数量:

1 极对= 2 极。

Table 19 Motor data for configuration:表 19 配置电机数据:

Motor data 电机数据	Value 值	Comments 注释
I max	160	I max = 28*5.7 ≈ 160
I nom	28	Interpolation between 27.7 and 28.2 27.7 和 28.2 之间的插值
Num. of poles 极数	4	Number of motor poles 电机极数
Temperature sensor type 温度传感器类型	KTY/PTC	E3 option is a PTC thermistor, which is very similar to KTY 84. IMD’s KTY input is used for this type of sensor. E3 选项是 PTC 热敏电阻，与 KTY 84 非常相似。IMD 的 KTY 输入用于此类传感器
Maximum temperature 最高温度	23295	Insulation class F: 40° + 105° = 145. Extra 15° margin is added: 130°=23295 according to section 10.3.2.2 on page 231. (Data for KTY 84 conversion is used.) 绝缘等级 F:40°+105°=145。根据第 178 页第 10.3.2.2 节，增加额外的 15° 裕度: 130°=23295。（使用 KTY 84 转换数据。）
N nom	1440	Nominal speed 标称速度
F nom	50	Nominal frequency 标称频率
V nom	230	The motor is going to be connected



Motor data 电机数据	Value 值	Comments 注释
		as Δ with 230 V AC voltage 电机将连接为 Δ ，电压为 230v AC
Cos Phi	0.81	
Brake current 制动电流	High 高	The brake current is calculated from the brake consumption power: $65 \text{ W} / 24 \text{ V} = 2.7 \text{ A}$. 制动电流由制动消耗功率计算得出： 65 瓦/24 伏=2.7 安。
Brake output ON delay 制动输出开启 延时	110	Break release time. The release range is not specified, and therefore 10% delay is added. 中断释放时间。未指定释放范围，因此增加了 10% 的延迟。
Brake output OFF delay 制动输出关闭 延迟	275	Break braking time. The braking range is not specified, and therefore 10% delay is added. 中断制动时间。制动范围未指定，因此增加 10% 的延迟。
Resol. Poles Resol. 极数	2	Number of resolver poles 编码器极数

8.4.3 Configuring the safety run fields 配置安全运行字段

The “Servo” fields are general configurations of the IMD. The red dashed rectangle in the following figure shows the parameters that are to be configured.

“伺服” 字段是 IMD 的一般配置。下图中红色虚线矩形显示了需要配置的参数。

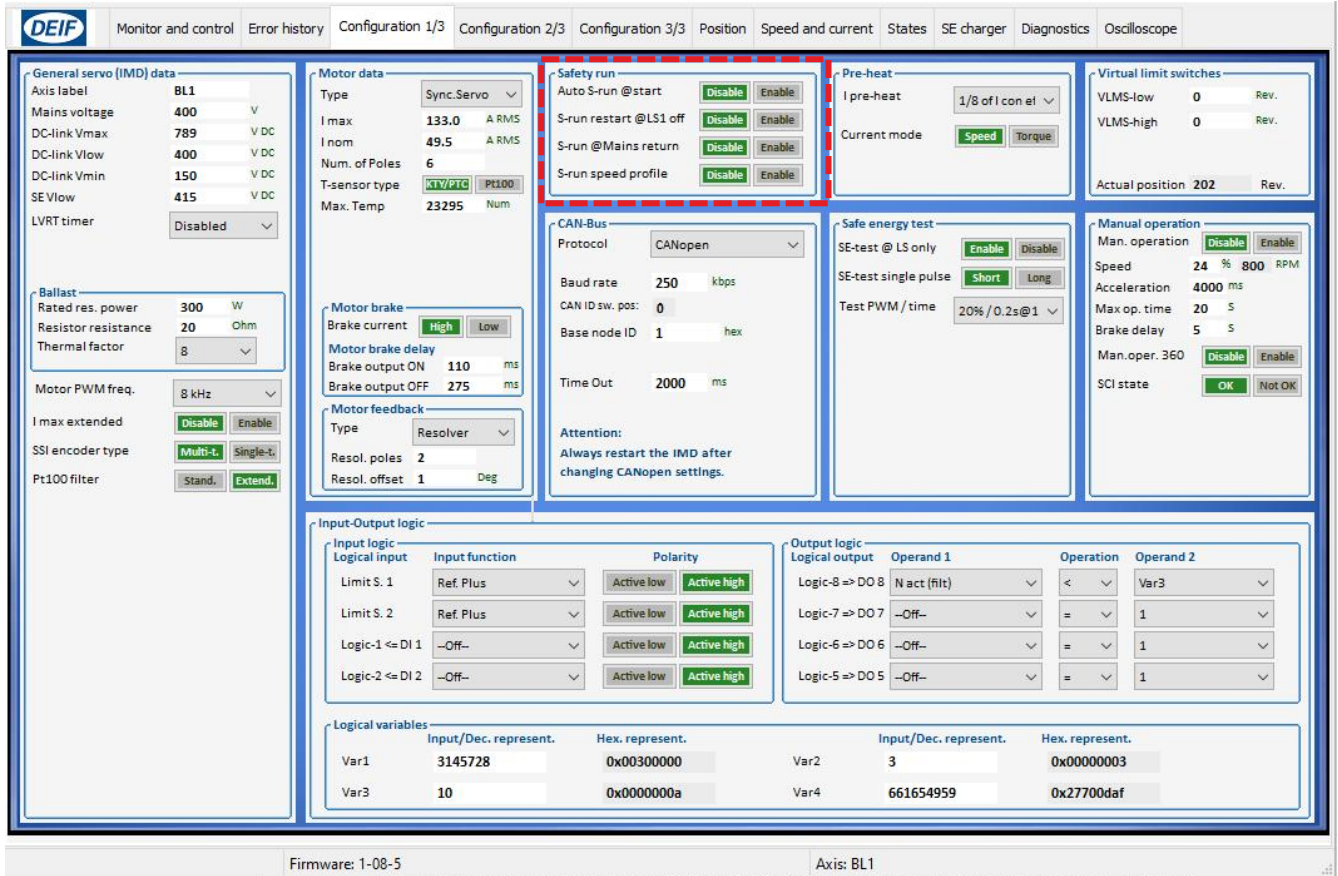


Figure 40 Safety run data in IMD Manager configuration 1/3

图 40 IMD 监控软件配置 1/3 中的安全运行数据

Fill in the following fields:填写以下字段:

- **Auto S-run @ start:** Auto safety-run @ start is a function that enables automatic safety-run at IMD power up, if no limit switch is active before or during the power up.

If a limit switch is not active during power up, the IMD will go to state 4 or 5 depending on the temperature. If the temperature is not too cold, it will end in state 5 (PwrOn not parked).

If Auto S-run @ start is *enabled*, it is not necessary to enable the drive with a command (or the Enable dev. button). It will be done automatically and the IMD will proceed from state 5 (PwrOn not parked) to state 19 (safety run setup) automatically as soon as RUN input is high.

If Auto S-run @ start is *disabled*, it is necessary to send the command or click on the Enable dev. button as well as set the RUN input is high, before the IMD will proceed from state 5 (PwrOn not parked) to state 19 (safety run setup).

See section 6.1 on page 68 for states chart and description.

自动安全运行 @ start: 自动安全运行@ start 是在 IMD 上电时自动安全运行的功能，前提是上电前或上电期间没有限位开关处于激活状态。

如果限位开关在上电时未激活，IMD 将根据温度进入 4 或 5 状态。如果温度不过于低，将以状态 5 结束(未停机上电)。

如果启用了自动安全运行@ start，则无需使用命令（或启用设备按钮）启用驱动器。一旦 RUN 输入高，IMD 将自动从状态 5（PwrOn 未停机）进入状态 19（安全运行设置）。

如果禁用了自动安全运行@ start，则需要发送命令或单击启用设备按钮并将 RUN 输入设置为高，然后 IMD 将从状态 5（PwrOn 未停机）进入状态 19（安全运行设置）。

状态图和说明见第 55 页第 6.1 节。

- S-run restart @ LS1 off:** Auto safety-run restart is a function that enables restart of a safety-run if limit switch 1 deactivates after a successful safety run in “Safety-run succeeded” or “Parked tripped” state (states 14 and 16, see section 6.1 on page 68). 自动安全运行重新启动是一种功能，如果在“安全运行成功”或“停机跳闸”状态下成功安全运行后限位开关 1 停用，则能够重新启动安全运行（状态 14 和 16，见第 55 页第 6.1 节）。

Enabled: If limit switch 1 is activated in a safety run and then deactivated while still in state 14 or 16 (Safety-run succeeded, Parked tripped), the IMD will restart the safety run. A delay of one second is added before the state changes from state 16 (Parked tripped) to state 17 (Parked ready), even if the safety chain is OK.

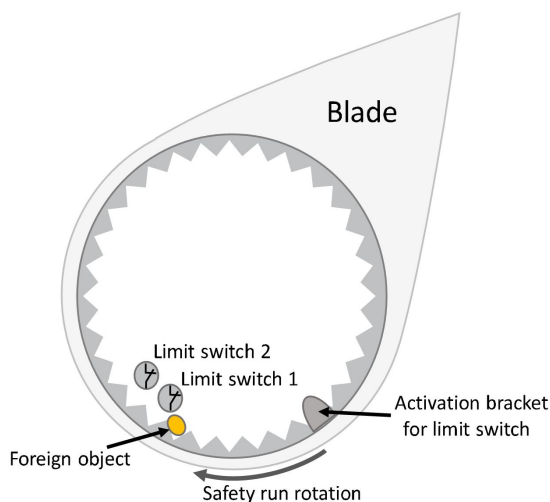
启用: 如果限位开关 1 在安全运行中激活，然后在仍处于状态 14 或 16（安全运行成功，停机跳闸）时停用，IMD 将重新启动安全运行。即使安全链正常，在状态从状态 16（停机跳闸）变为状态 17（停机就绪）之前，也会增加 1 秒的延迟。

Disabled: The safety run will not restart, even if limit switch 1 is deactivated while in state 14 or 16 (Safety-run succeeded, Parked tripped) after being activated during a safety run.

禁用: 即使限位开关 1 在安全运行期间激活后处于状态 14 或 16（安全运行成功，停机跳闸）时停用，安全运行也不会重新启动。

The function ensures that the safety run has actually moved the blade to stop position and in case a foreign object (can be a debris from the hub or blade such as loos bolts and so on) has activated the limit switch during the safety run, thus ending the safety run before the blade has actually reached stop position. The following figure illustrates such a scenario.

该功能可确保安全运行实际上已将叶片移动到停止位置，并且以防在安全运行期间异物（可以是轮毂或叶片的碎屑，例如松动螺栓等）激活限位开关，从而在叶片实际到达停止位置之前结束安全运行。下图说明了这种情况。



Without the auto safety-run restart function, the safety run will stop when the foreign object activates limit switch 1, even if the foreign object falls off and the limit switch is deactivated again.

If the auto safety-run restart function is enabled, the IMD will initiate a new safety run that will try to move the blade until a limit switch is activated. Note that the auto safety-run restart function can only be initiated from “Safety-run succeeded” or “Parked tripped”. If the safety-chain inputs are OK and the IMD entered “Parked ready” state, the auto safety-run restart function will not be initiated.

如果没有自动安全运行重启功能，当异物激活限位开关 1 时，安全运行将停止，即使异物脱落且限位开关再次停用。

如果启用自动安全运行重启功能，IMD 将启动新的安全运行，尝试移动叶片，直到激活限位开关。请注意，自动安全运行重启功能只能从“安全运行成功”或“停机跳闸”启动。如果安全链输入正常且 IMD 进入“停机就绪”状态，则不会启动自动安全运行重启功能。



Attention

It is recommended only to enable this function if two limit switches are implemented in the pitch system. If there is only one limit switch and it breaks during the activation, the function will cause the blade to continue pitching until the safety run timeout has past, thus bringing the blade to an unwanted position.

注意

建议只有在变桨系统中有两个限位开关时才开启此功能。如果只有一个限位开关，且在激活过程中断开，该功能将导致叶片继续变桨，直到安全运行超时结束，从而将叶片移至不需要的位罝。



Caution!

When this function is enabled, extra attention is required from installation and service personnel. If the IMD is in state “Parked tripped” and the limit switch breaks or for other reason deactivated, the blade might start pitching if no other precautions are taken.

小心

启用此功能时，安装和维修人员需要格外注意。如果 IMD 处于“停机跳闸”状态且限位开关断开或因其他原因停用，则如果未采取其他预防措施，叶片可能开始变桨。

- S-run @ mains return:** Safety run after AC mains missing during safety run, and return later on. This function only applies to systems where there is no safe energy, and the 24 V DC supply to the IMD is not interrupted (will have no effect in variants with internal 24 V DC power supply).
 Disable: Safety run is not resumed
 Enable: Safety run is automatically resumed when the AC mains returns while the IMD is in state 12 (Safety-run pending). The IMD goes to state 12 if the AC mains is missing during a safety run.

S-run @ 电源返回: 安全运行期间交流电源丢失后的安全运行，稍后重新接入。此功能仅适用于没有安全电源且 IMD 的 24 V DC 未中断的系统（在具有内部 24 V DC 的变型中不起作用）。

禁用：安全运行未恢复

启用：当 IMD 处于状态 12（安全运行待定）时，交流电源重新接入时，安全运行自动恢复。如果交流电源在安全运行期间丢失，IMD 进入状态 12。
- S-run speed profile:** S-run speed profile is a stepwise safety run, where four extra steps are defined with position and speed for each step.

Enabled: the configured speed profiled will be used whenever safety run is executed
 Disabled: Only step zero (N S-run (step 0) will be executed.

The position of the resolver must be calibrated when using a speed profile. Calibration is done placing the blade in position zero and using the Preset pos. function to set the number of resolver revolutions to zero (see section 9.2 on page 173)

安全运行速度配置文件:安全运行速度配置文件是一个逐步的安全运行，每一步的位置和速度都定义了四个额外的步骤。

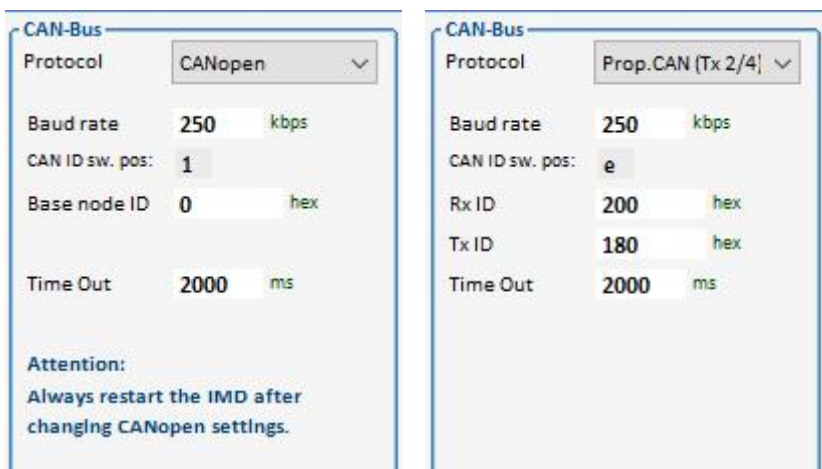
启用:当执行安全运行时，将使用配置的速度配置文件

禁用: 仅执行第 0 步 (N S-run (第 0 步))。

使用速度配置文件时，必须校准编码器的位置。校准完成后，将叶片置于零位，并使用预设位置功能将编码器转数设置为零（见第 132 页第 9.2 节）

8.4.4 Configuring the CAN bus 配置 CAN 总线

Configure the CAN interface (see also section 7.1 on page 84 for additional information). 配置 CAN 接口（有关更多信息，请参见第 66 页第 7.1 节）。



Parameters:参数:

- **Protocol:** Select the protocol to be used in the dropdown list 协议：在下拉列表中选择要使用的协议
- **Baud rate:** It is recommended to use 250 kbps to avoid communication errors and processor load 波特率：建议使用 250 kbps，以避免通信错误和处理器负载
- **CANopen, Base node ID:** Configure the node ID offset in Hexadecimal. The resulting address is Base node ID+CAN ID switch position/value.
CANopen, 基本节点 ID: 配置十六进制的节点 ID 偏移量。得到的地址是基本节点 ID+CAN ID 开关位置/值。
- **Prop.CAN, Rx ID:** Configure the receive address ID offset in Hexadecimal. The resulting address is Rx ID+CAN ID switch position/value.
Prop.CAN, Rx ID: 配置接收地址 ID 的偏移量，以 16 进制形式表示。得到的地址是 Rx ID+CAN ID 开关位置/值。
- **Prop.CAN, Tx ID:** Configure the transmit address ID offset in Hexadecimal. The resulting address is Tx ID+CAN ID switch position/value
Prop.CAN, Tx ID:配置发送地址 ID 偏移量，以 16 进制形式表示。得到的地址是 Tx ID+CAN ID 开关位置/值
- **Time Out:** Recommended timeout is between 2 to 3 seconds, should be a higher than the controller time out setting. Setting the timeout time to zero, disables the timeout function and no

error will be generated if the CAN/CANopen communication stops (at some point after initialization).

超时：建议超时时间在 2 到 3 秒之间，应高于控制器超时设置。将超时时间设置为零，将禁用超时功能，如果 CAN/CANopen 通信停止（在初始化后的某个时间点），则不会产生错误。

The “CAN ID sw.” is for information only. It shows the state of the CAD ID switch on the IMD.

CAN ID sw.仅供参考。它显示了 IMD 上 CAD ID 开关的状态。

CANopen: If the Base node ID or CAN ID switch are changed, the IMD must be restarted. See section [7.1.3.1](#) on page [90](#) for details about the IMD behaviour when the Base node ID or ID switch are changed.

CANopen: 如果更改了基本节点 ID 或 CAN ID 开关，则必须重新启动 IMD。有关更改基本节点 ID 或 ID 开关时 IMD 行为的详细信息，请参阅第 70 页第 7.1.3.1 节。

8.4.5 Configuring the safe energy test 配置后备电源测试

The purpose of the IMD safe energy test is to enable an external application to evaluate the state of the safe energy source, in order to ensure that the safe energy source is able to provide the needed energy at any time. Performing the test at regular intervals will enable timely replacement of the source if the batteries or ultra-caps are bad.

The safe energy test is done by doing the following:

1. Disconnecting the mains
2. Measuring the safe energy voltage
3. Slightly depleting the safe energy source with the ballast resistor and measuring the voltage again
4. Disconnecting the ballast resistor, waiting a specific time interval, and measuring the voltage once more
5. The state of the safe energy source can be estimated by evaluating the results (done by an external application)

IMD 后备电源测试的目的是使外部应用程序能够评估后备电源的状态，以确保后备电源能够随时提供所需的能量。如果电池或超级电容损坏，定期进行测试可以及时更换电源。

通过执行以下操作来完成安全能量测试：

1. 断开电源
2. 测量后备电源电压
3. 用制动电阻稍微消耗后备电源再测电压
4. 断开制动电阻，等待特定时间间隔，再次测量电压
5. 可以通过评估结果(通过外部应用程序)来估计后备电源的状态。

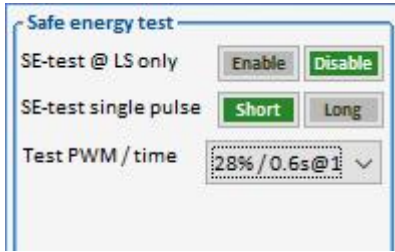
The whole process of the safe energy test is done by an external application SW, using the special functions in the IMD. Performing the test manually from the IMD Manager will not be adequate, since the timing cannot be precise enough.

The depletion of the safe energy source can be done in two ways:

后备电源测试的整个过程由外部应用软件使用 IMD 中的特殊功能完成。从 IMD 监控软件手动执行测试是不够的，因为计时不够精确。

后备电源的消耗可通过两种方式完成：

- Defining a duty cycle (PWM) and then starting (special command 5) and stopping (special command 6) the depletion with the special commands 定义占空比 (PWM)，然后使用特殊命令启动（特殊命令 5）和停止（特殊命令 6）耗尽
- Defining a single pulse (100% duty cycle) interval and using special command 15 to execute it. 定义单个脉冲（100%占空比）间隔，并使用特殊命令 15 执行该间隔。



There are three configuration parameters for the safe energy test:

1. **“SE-test @ LS only”**: Whether it is possible to execute a battery test only when a limit switch is activated (select “Enable”), or also when a limit switch is not activated (select “Disable”).
2. **“SE-test single pulse”**: Selecting whether a pulse duration will be short or long. The selection will give different values in the next parameter (drop down list). This is only applicable for pulse width and will not change PWM values.
3. **“Test PWM/time”**: Pulse width modulation, or pulse time (interval) when using a pulse width. Depending on the selection of short or long pulse, different values will be shown. If PWM is used, the setting of long or short pulse is ignored.

后备电源测试共有三个配置参数：

1. **“仅限 LS 时进行 SE 测试”**：是否可以仅在限位开关激活时（选择“启用”）或限位开关未激活（选择“禁用”）时执行电池测试。
2. **SE 测试单脉冲”**：选择短或长的脉冲持续时间。选择将在下一个参数（下拉列表）中给出不同的值。这仅适用于脉宽，不会改变 PWM 值。
3. **测试 PWM/时间”**：脉冲宽度调制，或使用脉冲宽度时的脉冲时间（间隔）。根据短脉冲或长脉冲的选择，将显示不同的值。如果使用 PWM，则忽略长脉冲或短脉冲的设置。

Table 20 PWM time definitions “Short” single puls

表 20 PWM 时间定义 “短” 单脉冲

Test PWM/time 测试 PWM/时间	Single pulse (s) 单脉冲（秒）	Time ON (ms) 开启时间（毫秒）	Time OFF (ms) 关闭时间（毫秒）	Total period (ms) 总周期（毫秒）
20%/0.2s@100%	0.2	0.25	1	1.25
25%/0.3s@100%	0.3	0.25	0.75	1
33%/0.4s@100%	0.4	0.25	0.5	0.75
50%/0.5s@100%	0.5	0.25	0.25	0.5
28%/0.6s@100%	0.6	0.5	1.25	1.75
33%/0.7s@100%	0.7	0.5	1	1.5
40%/0.8s@100%	0.8	0.5	0.75	1.25

Test PWM/time 测试 PWM/时间	Single pulse (s) 单脉冲 (秒)	Time ON (ms) 开启时间 (毫秒)	Time OFF (ms) 关闭时间 (毫秒)	Total period (ms) 总周期 (毫秒)
50%/0.9s@100%	0.9	0.5	0.5	1

Table 21 PWM time definitions "Long" single puls

表 21 PWM 时间定义 “长” 单脉冲

Test PWM/time 测试 PWM/时间	Single pulse (s) 单脉冲 (秒)	Time ON (ms) 开启时间 (毫秒)	Time OFF (ms) 关闭时间 (毫秒)	Total period (ms) 总周期 (毫秒)
20%/1s@100%	1	0.25	1	1.25
25%/2s@100%	2	0.25	0.75	1
33%/3s@100%	3	0.25	0.5	0.75
50%/4s@100%	4	0.25	0.25	0.5
28%/5s@100%	5	0.5	1.25	1.75
33%/6s@100%	6	0.5	1	1.5
40%/8s@100%	8	0.5	0.75	1.25
50%/10s@100%	10	0.5	0.5	1

Example: 示例

Executing special command 5 will start a PWM of 28% duty cycle (28% on, 72%off) until special command 6 is executed. Executing special command 15, will connect the ballast resistor for a period of 0.6 seconds, and then disconnect it.

执行特殊命令 5 将启动占空比为 28% 的 PWM(28% 开启, 72% 关闭), 直到特殊命令 6 被执行。执行特殊命令 15, 将制动电阻连接 0.6 秒, 然后断开。

SE-test single pulse: Short
Test PWM/time: 28% / 0.6s@100%
SE-测试单脉冲: 短
测试 PWM/时间: 28% / 0.6s@100%

Selecting Long single pulse will change the value in the selectable list to: 28% / 5s@100%. Executing special command 5 will start a PWM of 28% duty cycle (28% on, 72%off) until special command 6 is executed. Executing special command 15, will connect the ballast resistor for a period of 5 seconds, and then disconnect it

选择长单脉冲会将可选列表中的值更改为: 28%/5s@100%。执行特殊命令 5 将启动占空比为 28% 的 PWM(28% 开启, 72% 关闭), 直到特殊命令 6 被执行。执行特殊命令 15, 将制动电阻连接 5 秒, 然后断开。

SE-test single pulse: Long
Test PWM/time: not changed manually
SE-测试单脉冲: 长
测试 PWM/时间: 不手动更改



Attention

Single pulse longer than 1s might damage the built-in ballast resistor, depending on the safe energy voltage.

注意

单脉冲大于 1 秒 可能会损坏内置制动电阻，具体取决于后备电源电压。

8.4.6 Configuring pre-heating 配置预热

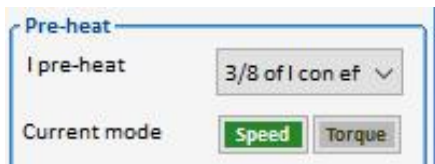
There are two configuration parameters for the pre-heating 预热有两个配置参数

- I pre-heat: the current that will used for pre-heating: 1/8 to 8/8 of I con eff (defined in reg. 0xC5). Select the desired current from the dropdown list.

I 预热：用于预热的电流：I con eff（在 reg. 0xC5 中定义）的 1/8 到 8/8。从下拉列表中选择所需的电流。

- Current mode: Select whether the speed or torque parameters are used during pre-heating. It is recommended to select Speed.

电流模式：选择在预热时使用速度参数还是扭矩参数。建议选择速度。

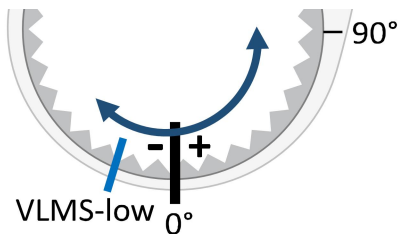


8.4.7 Configuring virtual limit switches 配置虚拟限位开关

The VLMS' function is based on the resolver's number of revolutions. Zero calibration must be performed to use the VLMS. "Limit +" and "Limit -" flags are used for the VLMS function.

VLMS 的功能基于编码器的转数。必须执行零校准才能使用 VLMS。“Limit +”和“Limit -”标志用于 VLMS 功能。

- VLMS-low: defines the number of full revolutions value for the low virtual switch. The position for the VLMS-low is positive if before zero, and negative if past zero:定义低虚拟开关的完整转数值。VLMS-low 的位置如果在零之前为正，如果超过零则为负：



- VLMS-high: defines the number of full revolutions value for the high virtual switch. The position for the VLMS-high is always positive.定义高虚拟交换机的满转数值。VLMS-high 的位置始终为正。



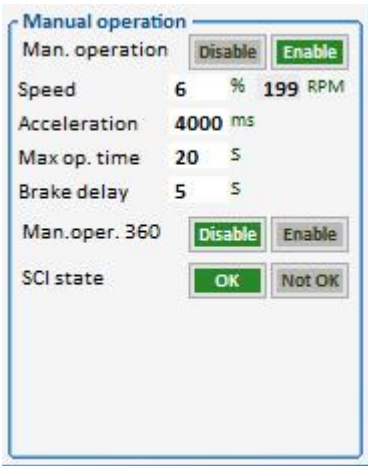
The actual position shows the actual position of the motor in full revolutions for information purpose.
实际位置显示了电机在满转数中的实际位置，以供参考。

8.4.8 Configuring manual operation 配置手动操作

Manual operation has the following configuration parameters that must be configured before it can be used:

手动操作具有以下配置参数，必须先配置这些参数才能使用：

- **Manual operation Enable/disable:** click on “Enable” to enable entering into manual operation mode. When “Enable” is clicked, digital inputs 10, 11 and 12 are reserved for manual operation. 手动操作启用/禁用：点击“启用”按钮，可进入手动操作模式。单击“启用”时，保留数字输入 10、11 和 12 用于手动操作。
- **Speed:** the speed that will be used during manual operation. The speed is entered in percentage of Nmax-100. The resulting speed in RPM is shown. 速度：手动操作期间使用的速度。以 Nmax-100 的百分比输入速度。显示以 RPM 为单位的的结果速度。
- **Acceleration:** Ramp time that will be used for the acceleration from zero to manual operation speed. It is given in ms from zero to Nmax-100. The actual time in ms used to accelerate from zero to the manual speed can be calculated as: $\text{acceleration time} * \text{speed percent} / 100$. 加速度：用于从零加速到手动操作速度的坡道时间。给出的是从零到 Nmax-100 的毫秒。从零加速到手动速度所用的实际时间（毫秒）可以计算为：加速时间*速度百分比/100。
- **Max op. time:** the maximum operation time of the motor in seconds. After this time the motor will stop even if an input is still high. It is still possible to cycle the input and the motor will start again with new operation time. 最大运行时间：电机的最大运行时间（秒）。在此之后，即使输入仍然很高，电机也将停止。仍然可以循环输入，电机将以新的运行时间再次启动。
- **Brake delay:** A delay from motor stop until the brake is engaged in seconds. It is intended to prevent the brake from being engaged / disengaged multiple times during a short period of time if the manual operation is used in pulses. 制动器延迟：从电机停止到制动器接合的延迟（秒）。如果在脉冲中使用手动操作，其目的是防止制动器在短时间内多次接合/分离。
- **Man. oper. 360:** Enables or disables the possibility to ignore VLMS while in manual operation mode. When “Enable” is clicked, digital input 9 is reserved for manual operation 360. 启用或禁用在手动操作模式下忽略 VLM 的可能性。单击“启用”时，保留数字输入 9 用于手动操作。
- **SCI state:** Defines the state of SCI (safety chain inputs) that manual operation is possible: SCI 状态：定义可以手动操作的 SCI（安全链输入）状态：
 - **OK:** safety chain inputs must be OK to enter manual operation mode
OK：安全链输入必须正常才能进入手动操作模式
 - **Not OK:** safety chain inputs must be not OK (safety chain tripped) to enter manual operation mode
Not OK：安全链输入不正常（安全链跳闸）才能进入手动操作模式



8.4.9 Configuring input-output logic 配置输入输出逻辑



Attention

Configuration of external fan control (if mounted in the IMD) and limit switch are mandatory.

注意

必须配置外部风扇控制装置（如果安装在 IMD 中）和限位开关。

The logical mapping to inputs and outputs is done in the “Input-output logic” group.

The mandatory definitions are:

输入和输出的逻辑映射在“输入-输出逻辑”组中完成。

强制性定义是：

- **Limit S.:** At least one limit switch must be defined as “Ref. Plus”. If no “Ref Plus” is defined the safety run will always end with timeout. Ensure that the correct polarity for the switch is defined. 限位开关:必须定义至少一个限位开关为“Ref.+”。如果没有定义“Ref Plus”，安全运行将总是以超时结束。确保定义的开关极性正确。
- **Logic 8 => DO8 (IMD 122 B only):**
It is recommended to configure the IMD so the fan cools automatically when needed according to the following table:
Logic 8 => DO8 (仅限 IMD 122 B):

建议将 IMD 配置为需要时自动冷却，具体配置方法如下表所示：

Table 22 Fan start and stop

表 22 风机启停

Reason for start 开始的原因	Start (approximately) 开始 (大约)	Stop (approximately) 停止 (大约)
Output module temperature 输出模块温度	Above 高于 60 °C	Below 低于 55 °C
Load on ballast resistor 制动电阻负载	Above 高于 25 %	Below 低于 12.5 %

Configuring the output as a logical output will automatically configure the fan function for the recommended start and stop. Control of external fan connection (it is recommended to connect the fan to DO 8). Operand 1 = In Block, Operation = On, Operand 2 = VarX, VarX = 0x300000 (VarX is one of the four logical variables: Var1, Var2, Var3, or Var4)

Operand 2 does not have to be Var2, but the same variable that is defined as Operand 2 must also be defined as 0x300000. 0x300000 is a mask that enables Logic in block (Reg. 0x9B) bits 20 (status of Ballast load $\geq 25\%$) and 21 (Temp IGBT $\geq 60^\circ\text{C}$). if any of these flags equals one, the fan will be turned on.

将输出配置为逻辑输出将自动配置风扇功能为推荐的启动和停止。控制外部风扇连接(建议将风扇连接到 DO 8)。操作数 1 = In Block, 操作= On, 操作数 2 = VarX, VarX = 0x300000 (VarX 是四个逻辑变量之一:Var1, Var2, Var3, 或 Var4)

操作数 2 不一定是 Var2, 但是定义为操作数 2 的相同变量也必须定义为 0x300000。0x300000 是一个掩码, 用于启用 Block 中的逻辑 (Reg. 0x9B) 第 20 位 (镇流器负载状态 $\geq 25\%$) 和第 21 位 (温度 IGBT $\geq 60^\circ\text{C}$)。如果这些标志中的任何一个等于 1, 风扇将被打开。

Input-Output logic							
Input logic		Polarity		Output logic			
Logical input	Input function	Active low	Active high	Logical output	Operand 1	Operation	Operand 2
Limit S. 1	Ref Plus	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Logic-8 => DO 8	In Block	On	Var2
Limit S. 2	--Off--	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Logic-7 => DO 7	--Off--	=	0
Logic-1 <= DI 1	--Off--	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Logic-6 => DO 6	--Off--	=	0
Logic-2 <= DI 2	--Off--	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Logic-5 => DO 5	--Off--	=	0

Logical variables					
	Input/Dec. represent.	Hex. represent.		Input/Dec. represent.	Hex. represent.
Var1	0	0x00000000	Var2	3145728	0x00300000
Var3	0	0x00000000	Var4	0	0x00000000

Any other application specific definitions can be made. See IMD Manager user manual for details about how to configure the input and output logic.

可以进行任何其他特定于应用程序的定义。有关如何配置输入和输出逻辑的详细信息, 请参阅 IMD 监控软件用户手册。

8.5 Configuring the control parameters data 配置控制参数数据

Control parameters are configured in “Configuration 2/3” tab.控制参数在“配置 2/3”选项卡中进行配置。

- Speed 速度
- Current 电流
- Magnetic field weakening 磁场削弱
- Position 位置

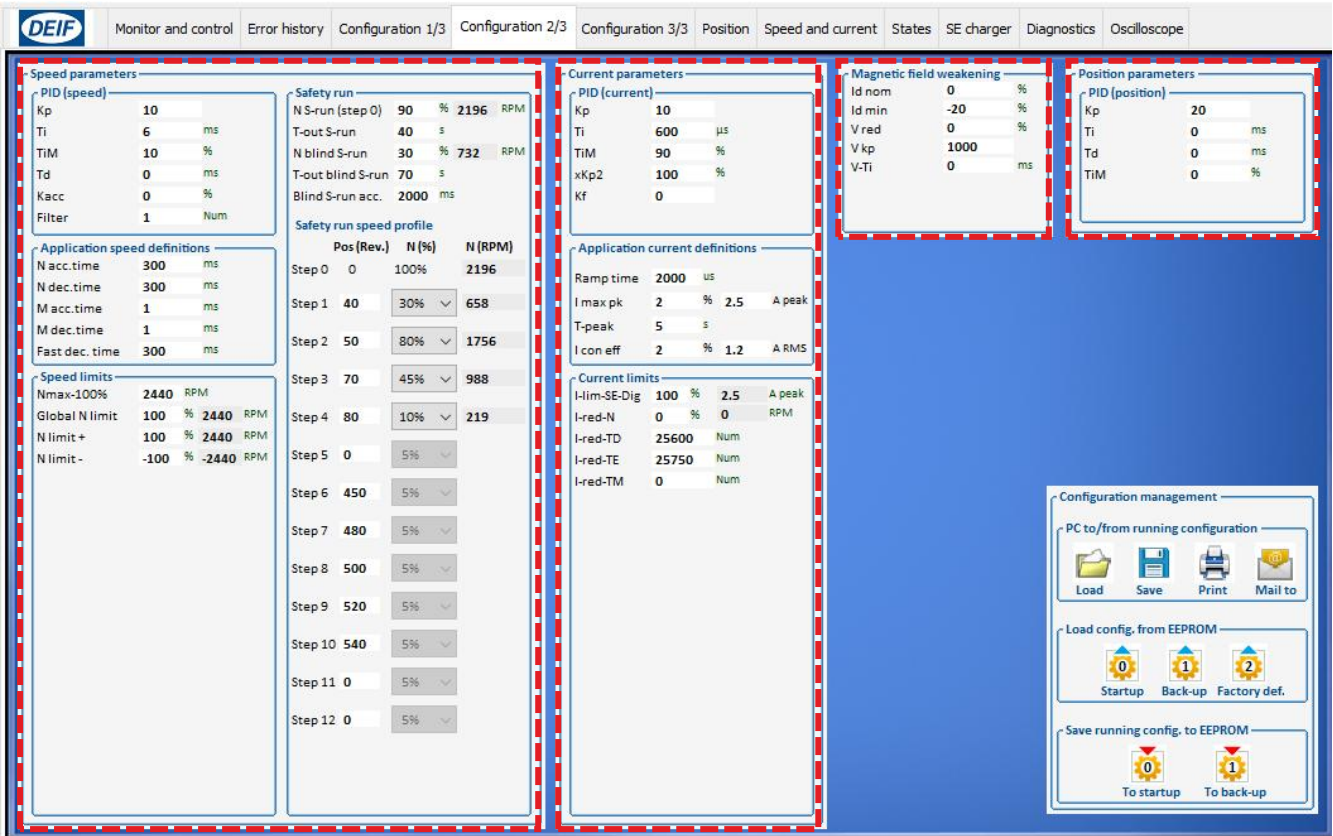


Figure 41 Parameter data

图 41 参数数据

These parameters define the PID control characteristics as well as the limits that will be applied. The following sub sections describe how to fill these parameters.

For a detailed description of the function of parameters such as T-peak, I-con eff, and so on, see IMD 100 function description.

这些参数定义了 PID 控制特性以及应用的限制。以下小节描述了如何填充这些参数。

有关参数 T-peak、I-con eff 等功能的详细描述，请参见 IMD 100 功能概述。

8.5.1 General PID parameters 一般 PID 参数

The IMD is a PID (Proportional Integral Derivative) controller and while explaining PID controllers is outside the scope of this manual (information which is widely available), this section describes the general PID parameters that are configured in the following sections.

There are four parameters which can be configured in the Current, Speed and Position parameters (the parameters in the current are slightly different). These are: Kp, Ti, Tim, Td.

These parameters determine the following (illustrated in [Figure 42](#) on page [137](#)):

IMD 是 PID（比例-积分-微分）控制器，虽然解释 PID 控制器不在本手册的范围内（信息广泛可用），但本节描述了在以下章节中配置的常规 PID 参数。

有四个参数可在电流、速度和位置参数中配置（电流中的参数略有不同）。这些是：Kp、Ti、Tim、Td。

这些参数确定以下内容（如第 104 页的图 42 所示）：

- How fast the motor will reach its set point 电机到达设定点的速度
- Overshoot when set point is reached 达到设定点时的过冲
- Settling time of over/undershoot 过冲/下冲的稳定时间
- Final error 最终错误

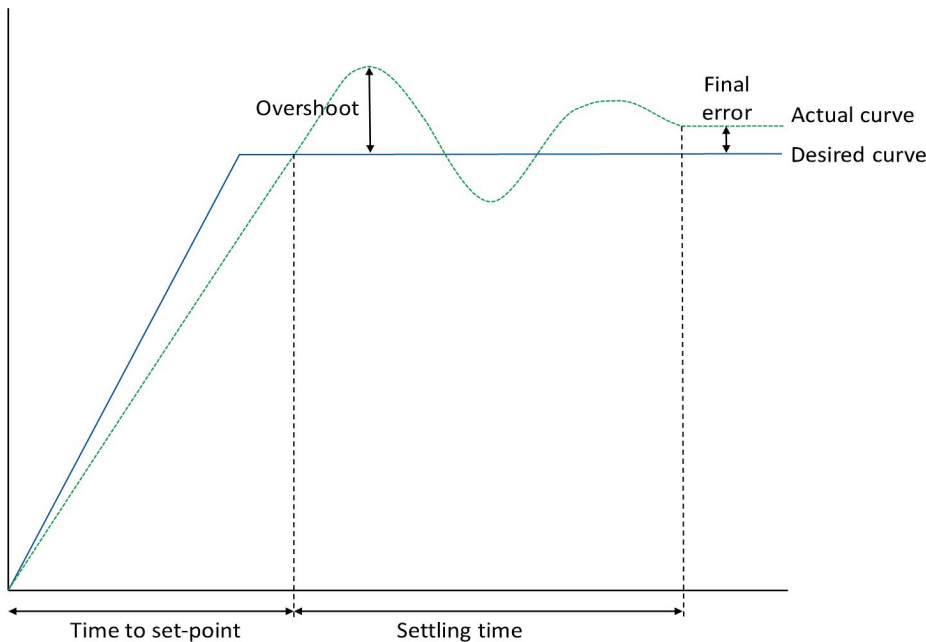


Figure 42 PID parameters

图 42 PID 参数

The following table show how increasing the value of configured parameters affect the actual curve: 下表显示了增加配置参数的值对实际曲线的影响:

Parameter 参数	Time to set point 设定点时间	Overshoot 过冲	Settling time 设定时间	Final error 最终错误
Kp ↑	shorter 更短	Larger 更长	Little effect 影响不大	Smaller 更小
Ti ↑	shorter 更短	Larger 更长	Longer 更长	Eliminated 消除
Td ↑	Little effect 影响不大	Smaller 更小	Shorter 更短	Little effect 影响不大

The Tim parameter, limits the maximum possible effect of Ti. It can be compared to setting a maximum speed limit. As long as the speed is under the limit, it can be changed very rapidly. Once it gets above the limit it will be limited, and not be allowed to increase any more. It can be useful for example to limit the effect of the integral part (Ti) when the blade is subjected to turbulence for a short while, which increases the torque and then disappears. Limiting the Ti with the Tim parameter will ensure that the motor doesn't suddenly get too much power.

Several control loops are part of the total blade control, and not all of them are controlled by the IMD. This must be taken into account when the PID parameters of the IMD are configured.

It is recommended to use the scope of the IMD Manager when optimizing the PID parameters.

The following examples show the influence of changing PID parameters, as captured by the scope in the IMD Manager. They are not meant as tutorial, merely to show how optimization can be performed.

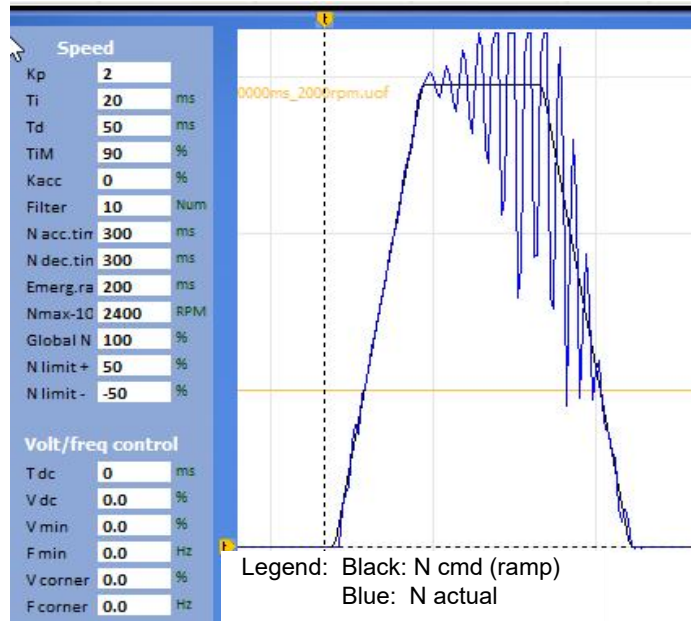
Tim 参数限制了 Ti 的最大可能影响。可以将其与设置最大速度限制进行比较。只要速度在极限之下，就可以非常迅速地改变。一旦超过这个限度，就会受到限制，不能再增加。例如，当叶片受到短时间湍流的影响时，限制整体部分 (Ti) 的影响可能很有用，这会增加扭矩然后消失。使用 Tim 参数限制 Ti 将确保电机不会突然之间获得过多功率。

几个控制回路是整个叶片控制的一部分，并非所有回路都由 IMD 控制。在配置 IMD 的 PID 参数时必须考虑到这一点。

建议在优化 PID 参数时使用 IMD 监控软件的范围。

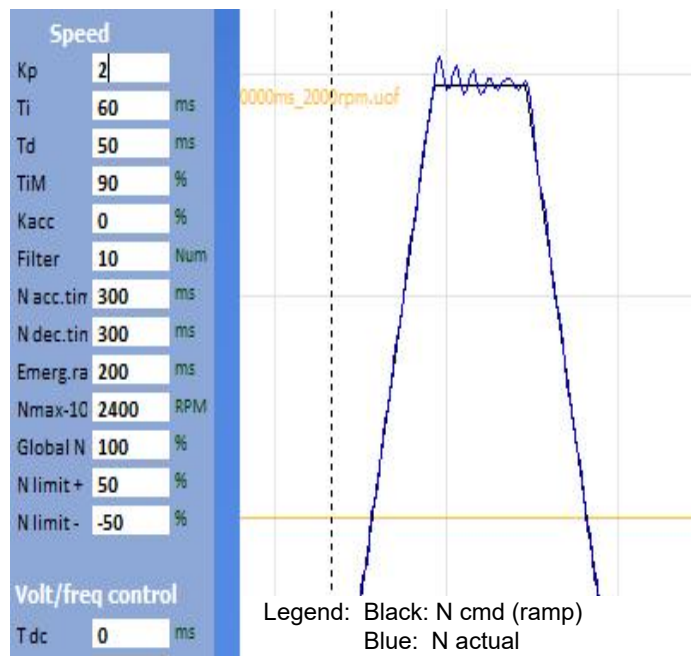
以下示例显示了更改 PID 参数的影响，从 IMD 监控软件中的范围捕获。它们不是教程，只是为了展示如何执行优化。

In this parameter settings, settling time is very long. On the other hand, the overshoot is very small. The Ti parameter is relatively low (20), which causes the motor to oscillate.在这个参数设置中，调节时间很长。另一方面，过冲非常小。Ti 参数相对较低 (20)，这会导致电机震动。



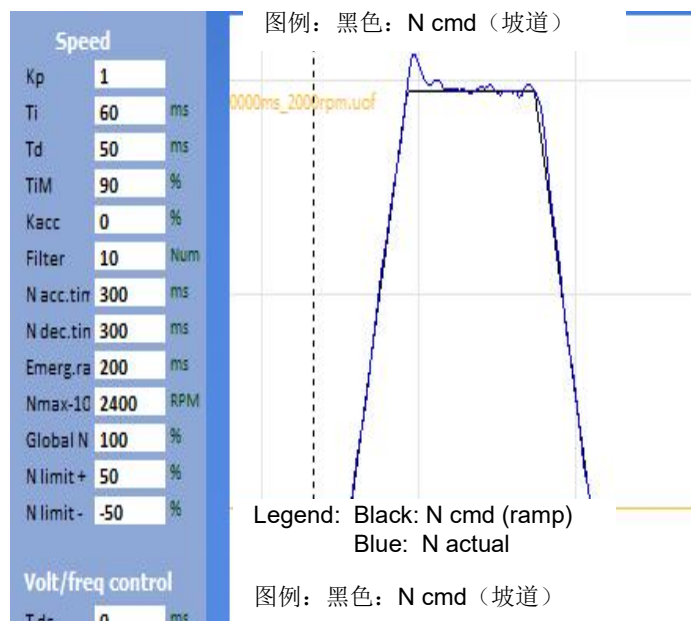
The Ti parameter is set higher (60). Settling time is shorter. On the other hand, the overshoot is slightly higher.

Ti 参数设置得更高 (60)。调节时间较短。另一方面，过冲略高。



The Kp parameter is set lower (1). Settling time is shorter. On the other hand, the overshoot is slightly higher.

Kp 参数设置得较低 (1)。调节时间更短。另一方面，过冲略高。



8.5.2 Configuring speed parameters 配置速度参数

Speed parameters

PID (speed)

Kp	10	
Ti	6	ms
TiM	10	%
Td	0	ms
Kacc	0	%
Filter	1	Num

Application speed definitions

N acc.time	300	ms
N dec.time	300	ms
M acc.time	1	ms
M dec.time	1	ms
Fast dec. time	300	ms

Speed limits

Nmax-100%	3268	RPM
Global N limit	100	% 3268 RPM
N limit +	100	% 3268 RPM
N limit -	-100	% -3268 RPM

Safety run

N S-run (step 0)	90	%	2941	RPM
T-out S-run	50	s		
N blind S-run	30	%	980	RPM
T-out blind S-run	70	s		
Blind S-run acc.	2000	ms		

Safety run speed profile

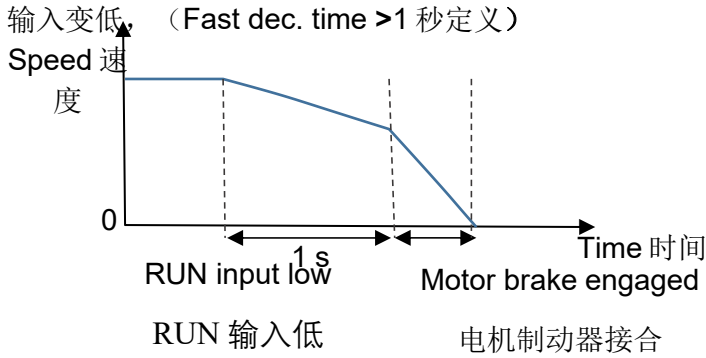
	Pos (Rev.)	N (%)	N (RPM)
Step 0	0	100%	2941
Step 1	20	30%	882
Step 2	50	110%	3235
Step 3	100	45%	1323
Step 4	120	15%	441
Step 5	180	20%	588
Step 6	200	25%	735
Step 7	220	30%	882
Step 8	240	35%	1029
Step 9	260	30%	882
Step 10	280	25%	735
Step 11	300	20%	588
Step 12	320	10%	294

Fill in the following fields:填写以下字段:

- **PID (proportional–integral–derivative) control parameters:** Only experienced and qualified person should adjust these parameters (see also section [8.5.1](#) on page [136](#)).
- PID（比例-积分-微分）控制参数：只有经验丰富且合格的人员才能调整这些参数（另见第 103 页第 8.5.1 节）。
 - **Kp:** Proportional amplification in the speed controller. 速度控制器中的比例放大。
 - **Ti:** Integration time for the speed controller. 速度控制器的集成时间。
 - **Td:** Differential time constant for the rate time in the speed controller. 速度控制器中速率时间的微分时间常数。
 - **TiM:** Maximum value of the speed integral memory. 速度积分存储器的最大值。
 - **Kacc:** Dynamic acceleration value directly to the current controller. There is a risk of current oscillations if this parameter is adjusted too high. 直接给当前控制器的动态加速度值。如果此参数调整得太高，则存在电流振荡的风险。

- **Filter:** Low-pass filtering of the feedback input to the speed control. Used to decrease the variation of the speed in order to keep it stable. 速度控制反馈输入的低通滤波。用于减少速度变化以保持稳定。
- **Application speed definitions 应用程序速度定义**
The purpose of acceleration and deceleration ramps is to lower the load on the motor and turbine during start and stop of pitch operation. 加速和减速坡道的目的是在变桨操作的启动和停止期间降低电机和涡轮机上的负载。
 - **N acc. time:** Time in ms that will be used to accelerate from zero RPM to Nmax-100% RPM. This time defines an acceleration ramp (slope) that will be applied whenever an acceleration is performed. 用于从零 RPM 加速到 Nmax-100%RPM 的时间，单位为毫秒。该时间定义了在执行加速时将应用的加速坡道（斜率）。
 - **N dec. time:** Time in ms that will be used to decelerate from Nmax-100% RPM to zero RPM. This time defines a deceleration ramp (slope) that will be applied whenever deceleration is performed. 用于从 Nmax-100%RPM 减速至零 RPM 的时间（毫秒）。该时间定义了在执行减速时将应用的减速坡道（斜率）。
 - **NOTE** When a limit switch is activated during a safety run, or a safety run time is exceeded, the shortest of *N dec. time* and *Fast dec. time* will be used. 注意：当在安全运行期间启动限位开关，或超过安全运行时间时，将使用最短的 *N dec.*时间和 *Fast dec.*时间。
 - **M acc. time:** Time in ms that will be used to accelerate from zero torque to max torque. This time defines an acceleration ramp (slope) that will be applied whenever an acceleration is performed. 将用于从零扭矩加速到最大扭矩的时间（以毫秒为单位）。该时间定义了在执行加速时将应用的加速坡道（斜率）。
 - **M dec. time:** Time in ms that will be used to decelerate from max torque to zero torque. This time defines a deceleration ramp (slope) that will be applied whenever deceleration is performed. 用于从最大扭矩减速到零扭矩的时间（以毫秒为单位）。该时间定义了在执行减速时将应用的减速坡道（斜率）。
 - **Fast dec. time:** Ramp time (slope) for emergency situation. This time is used (overrides the *N dec. time*) if any of the following situations occur: 紧急情况下的坡道时间（斜率）。如果发生以下任何一种情况，将使用此时间（覆盖 *N dec.* 时间）：
 - There is an error that forces a controlled motor stop. Note that some errors do not allow a controlled stop, and the brake will stop the motor. 有一个错误迫使受控电机停止。请注意，某些错误不允许受控停止，制动器将停止电机。
 - The drive is disabled while the motor is in motion. 电机运行时驱动器被禁用。
 - A limit switch is activated during a safety run, or a safety run timeout exceeded, and *Fast dec. time* < *N dec. time* 安全运行时限位开关被激活，或安全运行超时，且 *Fast dec. time* < *N dec. time*
 - RUN input goes low. If the deceleration defined is longer than 1 s, the output is disabled and the brake is engaged: 运行输入变低。如果定义的减速度大于 1 秒，则输出被禁用，制动器接合：

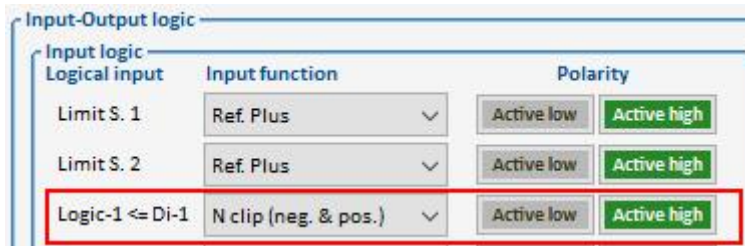
RUN input goes low, (Fast dec. time > 1s defined): RUN



• **Speed limits:速度限制:**

The speed limits can be defined globally, for a specific direction or both. It is always the lowest value that will be used. 可针对特定方向或两个方向全局定义速度限制。它始终是将要使用的最低值。

- **Nmax-100%:** Maximum speed in RPM. This is the speed that will be a base for any relative speed calculation. 以 RPM 为单位的最大转速。这是将作为任何相对速度计算基础的速度。
- **Global N Lim:** Global speed limit, for both directions. Defined as percent of Nmax-100%. This speed limit is always enabled and will not allow the speed to exceed this limit. 两个方向的全局速度限制。定义为 Nmax-100%的百分比。此速度限制始终处于启用状态，不允许速度超过此限制。
- **N Lim+, N Lim-:** Maximum speed limit, for positive (+) and negative (-) directions. Defined as percent of Nmax-100%. Commonly used in conjunction with position control. This speed limit is not active unless N-clip is enabled. Enabling N-clip can be achieved in one of the following ways: 正 (+) 和负 (-) 方向的最大速度限制。定义为 Nmax-100%的百分比。通常与位置控制一起使用。除非启用 N-clip，否则此速度限制不会激活。可以通过以下方式之一启用 N-clip:
 1. Set bit 6 in reg. 0x51 to 1 (set to zero to disable) 设置 reg.0x51 中的第 6 位到 1 (设置为零禁用)
 2. Configure a logical input to N clip. In the following example the N Lim+ and N Lim- will be enabled when the input Di-1 is high.: 配置 N clip 的逻辑输入。在以下示例中，N Lim+ 和 N Lim- 将为输入 Di-1 高时启用:



• Safety run 安全运行

Safety run			
N S-run (step 0)	90	%	2941 RPM
T-out S-run	50	s	
N blind S-run	30	%	980 RPM
T-out blind S-run	70	s	
Blind S-run acc.	2000	ms	
Safety run speed profile			
	Pos (Rev.)	N (%)	N (RPM)
Step 0	0	100%	2941
Step 1	20	30%	882
Step 2	50	110%	3235
Step 3	100	45%	1323
Step 4	120	15%	441
Step 5	180	20%	588
Step 6	200	25%	735
Step 7	220	30%	882
Step 8	240	35%	1029
Step 9	260	30%	882
Step 10	280	25%	735
Step 11	300	20%	588
Step 12	320	10%	294

- **N safety-run:** maximum speed during safety run. Defined as percent of Nmax-100%. A negative value in this parameter means that the motor will run the other way. 安全运行期间的最大速度。定义为 Nmax-100%的百分比。此参数中的负值表示电机将以另一种方式运行。

If a safety run speed profile is used:如果使用安全运行速度配置文件:

- The speed defined in this parameter is used for step 0 此参数中定义的速度用于步骤 0
 - If the speed in any steps of the speed profile is above 100%, N safety-run must be correspondently lower so that the archived speed does not exceeds Nmax-100%如果速度配置文件的任何步骤中的速度高于 100%，N 安全运行必须相应降低，以便存档速度不超过 Nmax-100%
- **T-out safety-run:** time out for safety run (the time after which the IMD will go from state 11 to state 18 (see section 6.1 on page 68) if a ref. Plus (limit switch) is not activated. 10 s is the minimum value.
- 安全运行的超时时间(在此之后，如果 ref. Plus(限位开关)未激活，IMD 将从状态 11 进入状态 18(参见第 55 页 6.1 节)。10s 为最小值。
- **N blind safety-run:** maximum speed during blind safety run (safety run without resolver feedback). Defined as percent of Nmax-100%. A negative value in this parameter means that the motor will run the other way.
- **N 盲安全运行:** 盲安全运行期间的最大速度（无编码器反馈的安全运行）。定义为 Nmax-100%的百分比。此参数中的负值表示电机将以另一种方式运行。

- **T-out blind safety-run:** time out for blind safety run (the time after which the IMD will go from state 11 to state 18 (see section [6.1](#) on page [68](#)) if a ref. Plus (limit switch) is not activated. 10 s is the minimum value.
- 盲安全运行超时:如果 ref. Plus(限位开关)未激活, 则盲安全运行的超时时间(在此之后, IMD 将从状态 11 进入状态 18(见第 55 页 6.1 节)。10s 为最小值。
- **Blind S-run acc.:** Acceleration ramp for blind safety run. The slope of the ramp is defined as the time it will take to accelerate from zero RPM to Nmax-100% RPM.
- 用于盲安全运行的加速坡道。坡道斜率定义为从零 RPM 加速到 Nmax-100%RPM 所需的时间。
- **Safety run speed profile:** (must be enabled in “Configuration 1/3”, “General servo” group). When using the speed profile, the resolver revolutions number must be calibrated to 0 at blade position zero using the Pos. preset (see section [9.2](#) on page [173](#)). Step 0 always start at 0 revolutions, with the configured “N S-run (step 0)” speed, and cannot be changed. Steps one to four must be configured, by entering the position where the step starts as absolute number of revolutions, and the speed that will be used from this position in percent of “N S-run (step 0)”. The direction is defined in “N S-run (step 0)”. Percentage is always positive. The absolute number means that the IMD will change step when the motor has turned the number of revolutions defined, independent of the direction.
- 安全运行速度配置文件: (必须在“配置 1/3”、“通用伺服”组中启用)。当使用速度配置文件, 必须使用位置预设于叶片位置零处将编码器转数校准为 0。(参见第 132 页第 9.2 节)。步骤 0 始终以 0 转开始, 并以配置的“N S-run (步骤 0)”速度运行, 并且不能更改。必须配置步骤 1 至步骤 4, 方法是输入步骤开始的位置作为绝对转数, 以及将从该位置使用的速度(以“N S-run (步骤 0)”的百分比表示)。方向在“N S-run (step 0)”中定义。百分比始终为正。绝对数意味着当电机转动了定义的转数时, IMD 将改变步骤, 与方向无关。

The number of revolutions per degree must be known in order to be able to configure the safety run speed profile. See IMD 100 function description for description on how to calculate the number of revolutions per degree.

If the profile does not need all steps, set the “Pos(Rev.)” to zero (1). This step and all following steps are ignored (2), and the IMD uses the speed from the last step before the zero position until the limit switch is reached. The IMD manager shows the ignored steps by disabling the speed selection and removing the “N(RPM)” value. If the zero is changed, the ignored steps will be enabled again.

In the following example step 6 is the last step that is executed:

必须知道每度的转数才能配置安全运行速度配置文件。有关如何计算每度转数的说明, 请参阅 IMD 100 功能概要。

如果配置文件不需要所有的步骤, 将“Pos(rev)”设置为零(1)。这一步和接下来的所有步骤都被忽略(2), IMD 使用从零位之前的最后一步直到达到限位开关的速度。IMD 监控软件通过禁用速度选择和删除“N(RPM)”值来显示被忽略的步骤。如果更改了零, 则将再次启用被忽略的步骤。

在下面的示例中, 步骤 6 是执行的最后一步:

Speed parameters

PID (speed)

Kp	10	
Ti	6	ms
TiM	10	%
Td	0	ms
Kacc	0	%
Filter	1	Num

Application speed definitions

N acc.time	300	ms
N dec.time	300	ms
M acc.time	1	ms
M dec.time	1	ms
Fast dec. time	300	ms

Speed limits

Nmax-100%	3268	RPM
Global N limit	100	% 3268 RPM
N limit +	100	% 3268 RPM
N limit -		% -3268 RPM

Safety run

N S-run (step 0)	90	%	2941	RPM
T-out S-run	50	s		
N blind S-run	30	%	980	RPM
T-out blind S-run	70	s		
Blind S-run acc.	2000	ms		

Safety run speed profile

	Pos (Rev.)	N (%)	N (RPM)
Step 0	0	100%	2941
Step 1	20	30%	882
Step 2	50	110%	3235
Step 3	100	45%	1323
Step 4	120	15%	441
Step 5	180	20%	588
Step 6	200	25%	735
Step 7	0	30%	
Step 8	240	35%	
Step 9	260	30%	
Step 10	280	25%	
Step 11	300	20%	
Step 12	320	10%	

When configuring the position, the number of revolutions any step must be higher than the previous step. If this is not the case, the number of revolutions will be shown in red:

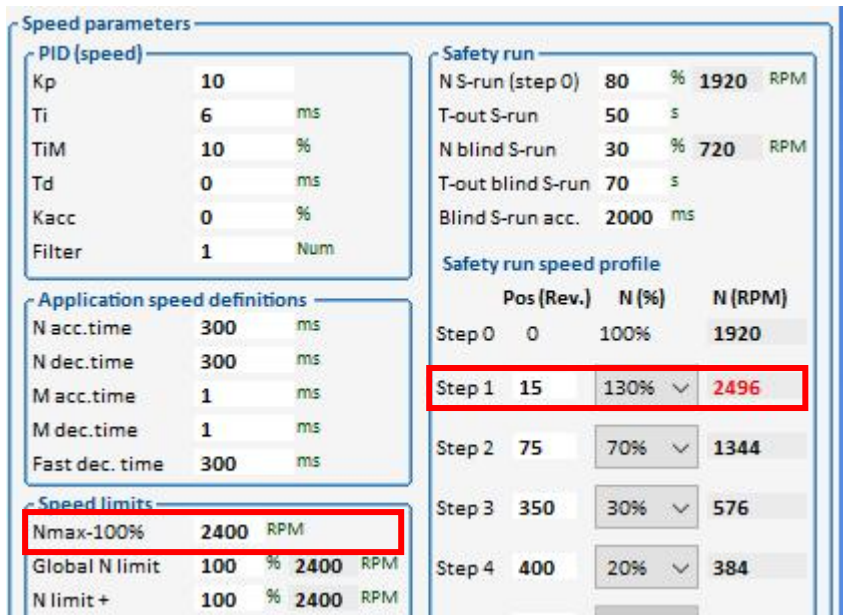
配置位置时，任何一步的转数都必须高于上一步。如果不是这种情况，转数将显示为红色：

Safety run speed profile

	Pos (Rev.)	N (%)	N (RPM)
Step 0	0	100%	1800
Step 1	30	80%	1439
Step 2	25	60%	1079
Step 3	93	40%	719

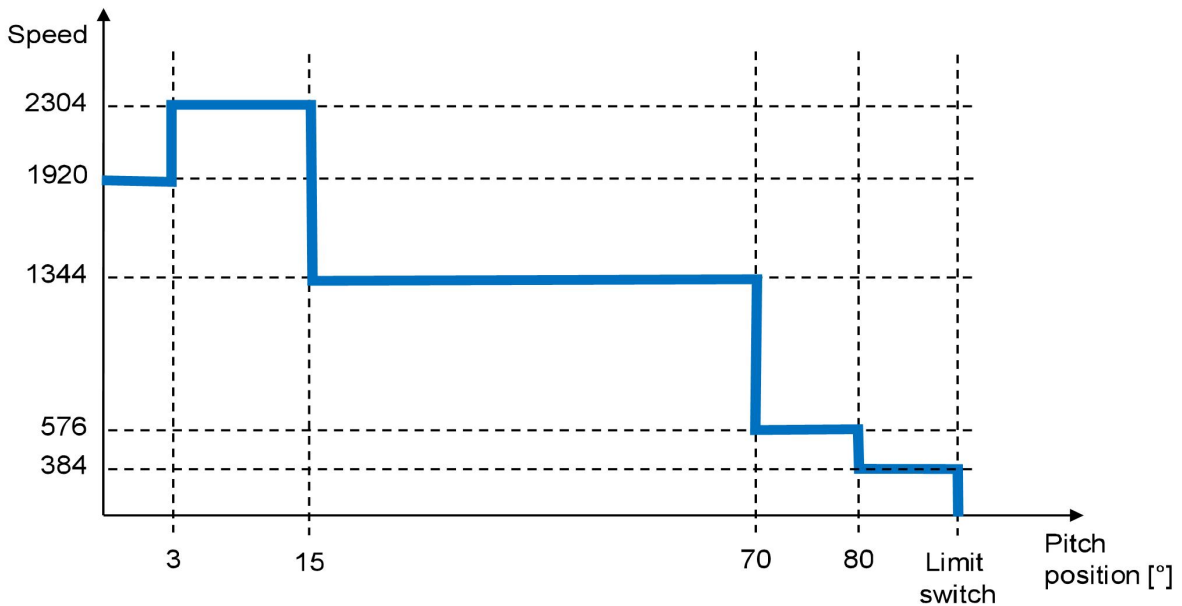
The speed is set by selecting a percentage value from the dropdown list, which allows values from 5% to 160%. If the resulting value exceeds Nmax-100%, the speed in RPM will be shown in red. If not corrected, the IMD will use Nmax-100% speed instead for this step:

通过从下拉列表选择一个百分比值来设置速度，该值允许从 5%到 160%的范围。如果结果值超过 Nmax-100%，以 RPM 为单位的转速将显示为红色。如果未纠正，IMD 将使用 Nmax-100% 速度代替此步骤：



Following is an example of a desired safety run curve (5 steps) and the configuration needed to achieve it:

以下是所需安全运行曲线（5 个步骤）以及实现该曲线所需的配置示例：



Assuming the total ratio of motor axis to blade rotation is 1800 (the ratio of revolutions per degree is five), and the N S-run (step0) is 1920, the four steps are configured as follows:

假设电机轴与叶片转动的总比值为 1800(每度转 5 圈)，N S-run (步骤 0)为 1920，四个步骤配置如下：

Step 步骤	No. of revolutions 转数	Speed (%) 速度	Speed (RPM) 速度 (RPM)
0	0	100	1920
1	15 (3x5)	120	2304
2	75 (15x5)	70	1344

Step 步骤	No. of revolutions 转数	Speed (%) 速度	Speed (RPM) 速度 (RPM)
3	350 (70x5)	30	576
4	400 (80x5)	20	384

The following figure shows the configuration in the IMD manager:

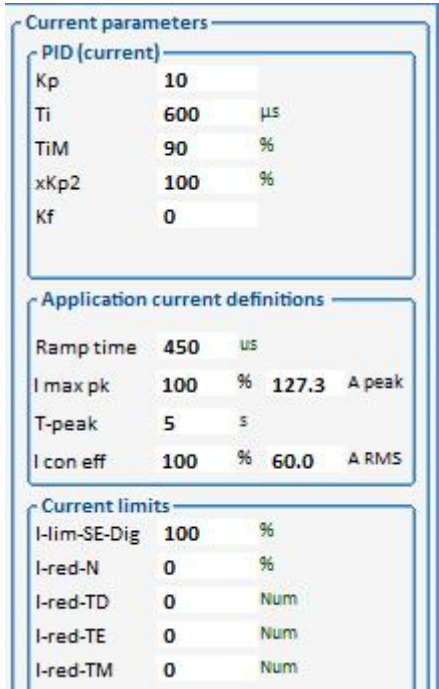
IMD 监控软件配置如下图所示:

The screenshot displays the configuration interface for the IMD manager, divided into several sections:

- Speed parameters:**
 - PID (speed):** Kp: 10, Ti: 6 ms, TiM: 10 %, Td: 0 ms, Kacc: 0 %, Filter: 1 Num.
 - Application speed definitions:** N acc.time: 300 ms, N dec.time: 300 ms, M acc.time: 1 ms, M dec.time: 1 ms, Fast dec. time: 300 ms.
 - Speed limits:** Nmax-100%: 2400 RPM, Global N limit: 100 % 2400 RPM, N limit+: 100 % 2400 RPM, N limit-: -100 % -2400 RPM.
- Safety run:**
 - N S-run (step 0): 80 % 1920 RPM
 - T-out S-run: 50 s
 - N blind S-run: 30 % 720 RPM
 - T-out blind S-run: 70 s
 - Blind S-run acc.: 2000 ms
- Safety run speed profile:**

	Pos (Rev.)	N (%)	N (RPM)
Step 0	0	100%	1920
Step 1	15	120%	2304
Step 2	75	70%	1344
Step 3	350	30%	576
Step 4	400	20%	384
Step 5	0	5%	
Step 6	450	5%	
Step 7	480	5%	
Step 8	500	5%	
Step 9	520	5%	
Step 10	540	5%	
Step 11	0	5%	
Step 12	0	5%	

8.5.3 Configuring current parameters 配置电流参数



Fill in the following fields:填写以下字段:

- **PID (proportional–integral–derivative) control parameters:** Only experienced and qualified person should adjust this parameter (see also section [8.5.1](#) on page [136](#)).
- PID (比例-积分-微分) 控制参数: 只有经验丰富且合格的人员才能调整该参数 (另见第 103 页第 8.5.1 节)。
 - **Kp:** Proportional amplification in the current controller. 电流控制器中的比例放大。
 - **Ti:** Integration time for the current controller. 电流控制器的积分时间。
 - **TiM:** Maximum value of the current integral memory. 电流积分存储器的最大值。
 - **xKp2:** Proportional amplification on overshoot current controller. 过冲电流控制器上的比例放大。
 - **Kf:** Feedforward amplification current controller. 前馈放大电流控制器。
- **Application current definitions 应用程序电流定义**
 - **Ramp time:** The time in us that the motor will accelerate from zero to I con eff. 电机从零加速到 I con eff 的时间。
 - **I max pk (%):** The maximum peak current. See description in IMD 100 function description. The value of this parameter is given as percentage of: 最大峰值电流。请参阅 IMD 100 功能概述中的说明。此参数的值以百分比形式给出:
 - IMD 122 (A_{pk}): Device design current (reg. 0xC6) * 1.5 * $\sqrt{2}$ 器件设计电流 (reg. 0xC6) * 1.5 * \sqrt{AA}
 - IMD 135 (A_{pk}): Device design current (reg. 0xC6) * 4 * $\sqrt{2}$ 器件设计电流 (reg. 0xC6) * 4 * \sqrt{AA}

The resulting current can be seen in **I max pk (A peak)** field. Note that this value is peak value and not RMS. The maximum is 100% unless I max extended is selected in the Servo fields (see section [8.4.2.1](#) on page [119](#)), or the IMD is ordered with Peak plus option, which allows for a higher value. Note that if the switching frequency is configured to a higher value than 8 kHz, the maximum allowed value is derated.产生的电流可以在 I max pk (A peak) 场中看到。请注意, 该值是峰值而不是 RMS。最大值为 100%, 除非在伺服字段中选择了 I max extended (请参阅第 91 页上的第 8.4.2.1 节) 或者订购具有 Peak plus 选项的 IMD, 这允许更高的值。请注意, 如果将开关频率配置为高于 8 kHz 的值, 则最大允许值会降低。

- **T-peak:** The maximum time that the current is allowed to be at I max pk. See function description in IMD 100 function description. The maximum is 6 seconds unless I max extended is selected in the Servo fields (see section 8.4.2.1 on page 119), in which case the maximum is 3 seconds.
- 允许电流达到 I max pk 的最长时间。参见 IMD 100 功能说明中的功能说明。最大值为 6 秒，除非在伺服字段中选择了 I max extended（见第 91 页第 8.4.2.1 节），在这种情况下，最大值为 3 秒。

I con eff (%): The maximum continuous current during drift (normal operation). See function description in IMD 100 function description, where this parameter is described as I-nom. The value of this parameter is given as percentage of Device design current (reg. 0xC6). The resulting current can be seen in I con eff (A RMS) field. Note that if the switching frequency is configured to a higher value than 8 kHz, the maximum allowed value is derated.

This parameter should not be set higher than the continues output current value specified in the IMD datasheet.

漂移（正常操作）期间的最大连续电流。参见 IMD 100 功能概述中的功能描述，其中该参数被描述为 I-nom。该参数的值以器件设计电流的百分比给出（reg. 0xC6）。产生的电流可以在 I con eff (A RMS) 字段中看到。请注意，如果将开关频率配置为高于 8 kHz 的值，则最大允许值会降低。

此参数不应设置为高于 IMD 数据表中指定的持续输出电流值。

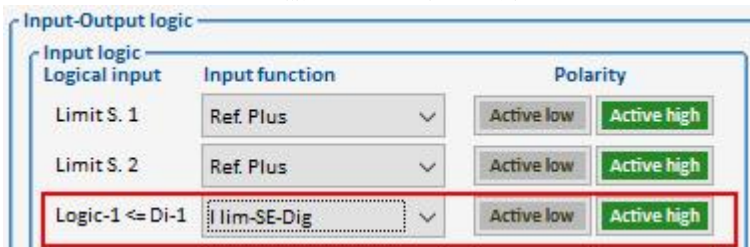
● **Current limits 电流限制**

- **I-lim-SE-dig:** A current limit that is used to lower the current in various situations. The main purpose of this current limit is to lower the energy used when safe energy is used. The current limit will be applied if any of the following conditions is true:
 - When there is no mains input
 - A CAN/CANopen command is sent, activating the current limit
 - An input for logical input that is configured to enable the current limit becomes active.
 In the following example the current limit will be activated when input Di-1 is high:

I-lim-SE-dig: 用于在各种情况下降低电流的电流限值。该电流限值的主要目的是降低使用后备电源时所使用的能源。如果满足以下任何条件，则将应用电流限制：

- 当没有电源输入时
- 发送 CAN/CANopen 命令，激活电流限制
- 配置为启用电流限制的逻辑输入的输入变为激活状态。

在以下示例中，当输入 Di-1 高时，将激活电流限制：



In this field the value of the current limit in % of I max pk is defined.

Use 100% if this function is not to be used. This is an optional parameter.

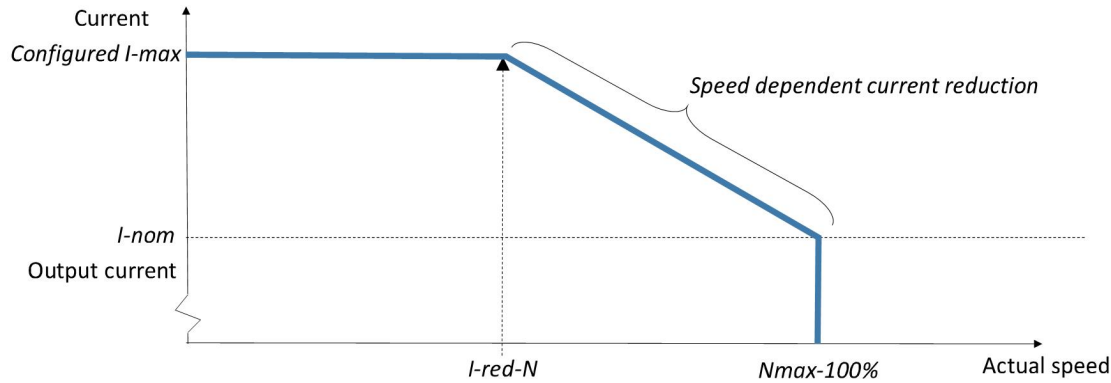
在该字段中，以 I max pk 的百分比为单位定义了电流限制值。

如果不使用此功能，请使用 100%。这是一个可选参数。

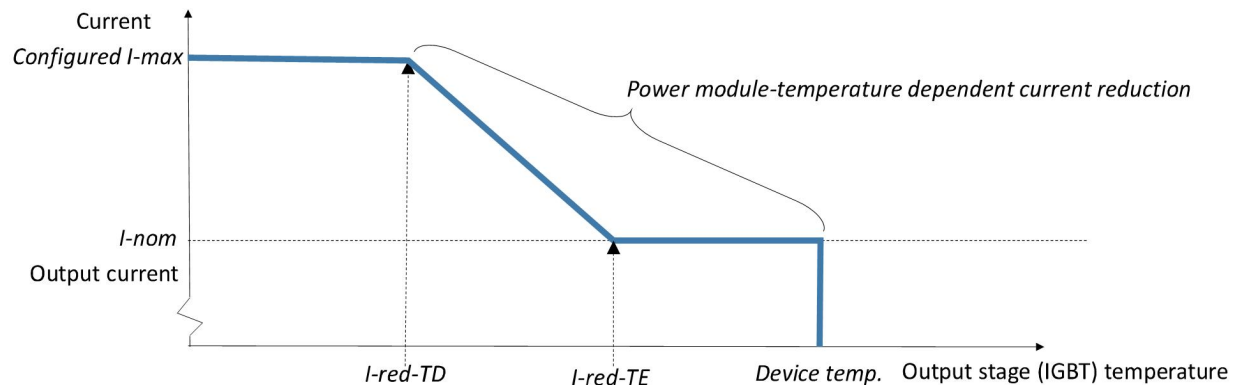
- **I-red-N:** Current limit that becomes effective due to speed, in percent of Nmax-100% (defined in reg. 0xC8). This parameter specifies the speed at which the current limitation start. The limit

is on I max pk, linear from I-red-N speed, until Nmax-100% speed where the limit reaches I nom. This current limit is dynamic and is always related to present speed. Zero disables the function. This is an optional parameter.

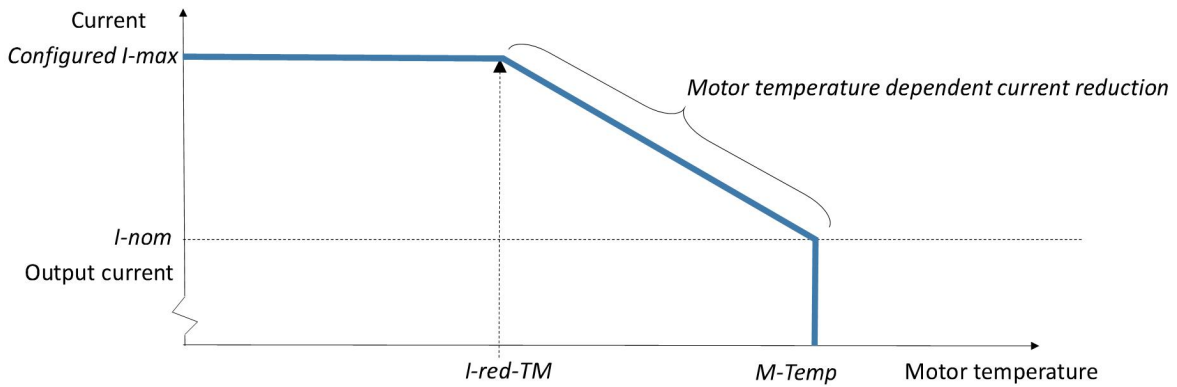
- 由于速度而生效的电流限制，以 Nmax-100% 的百分比表示（在 reg. 0xC8 中定义）。此参数指定电流限制开始的速度。极限值在 I 最大峰值处，从 I-red-N 速度到 Nmax-100%速度（极限值达到 I nom）呈线性。该电流限值是动态的，始终与当前速度有关。
零将禁用该功能。这是一个可选参数。



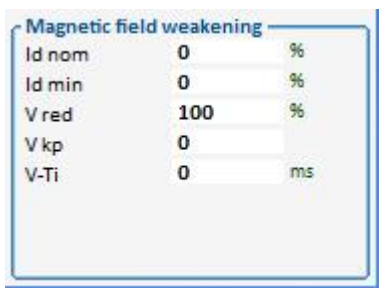
- **I-red-TD:** Current limit that becomes effective due to power module (IGBT) temperature. Start temperature in units. The limit is on I max pk, linear from temperature until TE temperature, where the limit reaches I nom at I-red-TE. This function is disabled if either I-red-TE is zero or if it is larger than I-red-TD. This is an optional parameter.
- 由于电源模块(IGBT)温度而生效的电流限制。起始温度单位。极限在 I 最大峰值处，从温度到 TE 温度呈线性变化，在 I-red-TE 时极限达到 I nom。如果 I-red-TE 为零或大于 I-red-TD，则禁用此功能。这是一个可选参数。



- **I-red-TE:** Current limit that becomes effective due to power module (IGBT) temperature. The temperature in units in which the current limit becomes equal to I nom. See I-red-TD. Setting I-red-TE is zero disables the function. This is an optional parameter.由于电源模块(IGBT)温度而生效的电流限制。电流极限等于 I nom 时的温度单位。参见 I-red-TD。将 I-red-TE 设置为零将禁用该功能。这是一个可选参数。
- **I-red-TM:** Ramp reduction from I red-TM to M-temp – Number is motor temperature. The reduction state changes as soon as the motor temperature is above the configured value. Can only be used when the temperature sensor in the motor is linear.从 I red TM 到 M-temp 的坡道降低 - 数字为电机温度。一旦电机温度高于配置值，还原状态就会改变。只能在电机中的温度传感器为线性时使用。



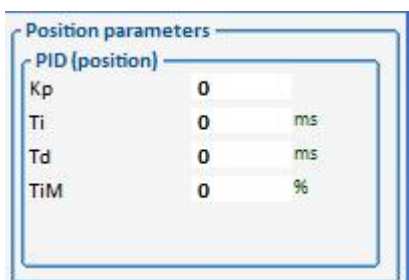
8.5.4 Configuring magnetic field weakening parameters 配置磁场弱化参数



Fill in the following fields:填写以下字段:

- **Id nom:** Magnetizing current in percent of the nominal current of the motor (from “Motor data” group). By optimizing this parameter (can only be done after additional motor parameters are configured – see section 8.6.2 on page 157) it is possible to achieve higher speed with the same load, resulting in higher speed in maximum modulation while in operation
- 励磁电流占电机额定电流的百分比（来自“电机数据”组）。通过优化此参数（只能在配置额外的电机参数后进行 - 参见第 120 页的第 8.6.2 节），可以在相同负载下实现更高的速度，从而在运行时实现更高的最大调制速度
- **Id min:** min. Id-current 50-80%最小 Id 电流 50-80%
- **V red:** Output voltage for the field weakening (80%)弱磁输出电压 (80%)
- **V kp:** Control amplification for the field weakening (500-2000)弱磁控制放大（500-2000）
- **V-Ti:** Rated time field control (0-2000). Too high value will cause oscillation 额定时间场控制（0-2000）。过高的值会引起振荡

8.5.5 Configuring position parameters 配置位置参数



Fill in the following fields:填写以下字段:

- **PID control parameters** (see also section [8.5.1](#) on page [136](#)):
- PID 控制参数（另请参见第 103 页上的第 8.5.1 节）：
 - **Kp**: Proportional amplification in the position controller. When this parameter is set to zero, position mode is disabled and it is not possible to set the motor to go to a specific position. Always use speed limits when position mode is enabled (see section [8.5.2](#) on page [140](#)). 位置控制器中的比例放大。当该参数设置为零时，位置模式被禁用，无法将电机设置到特定位置。
 - **Ti**: Integration time for the position controller. Only experienced and qualified person should adjust this parameter.位置控制器的积分时间。只有经验丰富且合格的人员才能调整此参数。
 - **Td**: Differential time constant for the rate time in the position controller. Only experienced and qualified person should adjust this parameter.位置控制器中速率时间的微分时间常数。只有经验丰富且合格的人员才能调整此参数。
 - **TiM**: Maximum value of the position integral memory. Only experienced and qualified person should adjust this parameter.位置积分存储器的最大值。只有经验丰富且合格的人员才能调整此参数。

8.6 Configuring async. motor parameters and resolver offset 配置异步电机参数和编码器偏移

8.6.1 Configuring resolver offset 配置编码器偏移



Info

This section is only applicable for Permanent magnet synchronous motor with resolver (EC Servo).

信息

本节仅适用于带编码器的永磁同步电机 (EC 伺服)。

The resolver offset needs to be determined once for each motor type. It is not a parameter that needs to be determined for each motor. It is determined during the integration process, and the offset value is then part of the configuration file.需要为每种电机类型确定一次编码器偏移。这不是一个需要为每个电机确定的参数。它是在集成过程中确定的，偏移值随后是配置文件的一部分。



Attention

If the motor manufacturer cannot guaranty that all motors of the same type are calibrated in the same way, each motor must be offset calibrated.

注意

如果电机厂家不能保证同一型号的所有电机都以相同的方式校准，则必须对每台电机进行偏置校准。

8.6.1.1 Prerequisites 先决条件

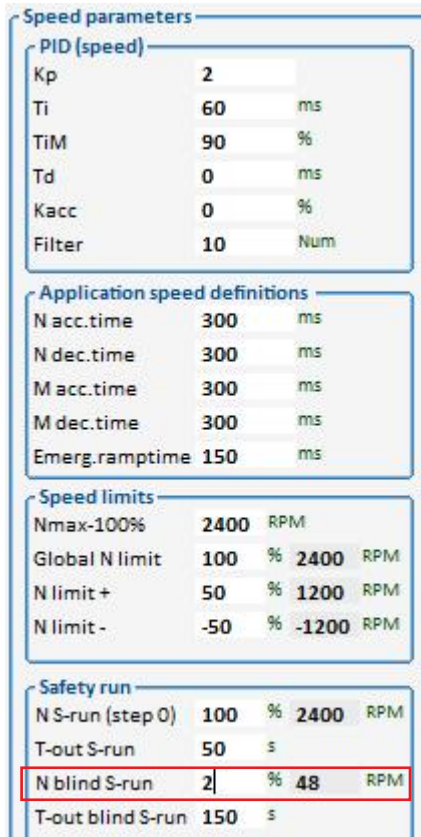
In order to perform the resolver, offset determination, the following is needed:为了执行编码器，确定偏移量，需要以下步骤:

- The IMD Manager must be running on a PC and connected to the IMD through the “Service” connector. IMD 监控软件必须在 PC 上运行，并通过“服务”连接器与 IMD 连接。
- The IMD must be configured for the motor used 必须为所使用的电机配置 IMD
- Power connections (mains and motor) must be connected 必须连接电源连接（电源和电机）
- The resolver must be connected to the IMD 编码器必须连接到 IMD
- The motor must be able to rotate free without load 电机必须能够在无负载的情况下自由旋转
- Safety-chain, RUN and RFE inputs must be valid. See section 5.5.2.1 on page 62 for safety-chain input information. RUN and RFE must be able to toggle.安全链、RUN 和 RFE 输入必须有效。有关安全链输入信息，请参阅第 50 页上的第 5.5.2.1 节。RUN 和 RFE 必须能够切换。

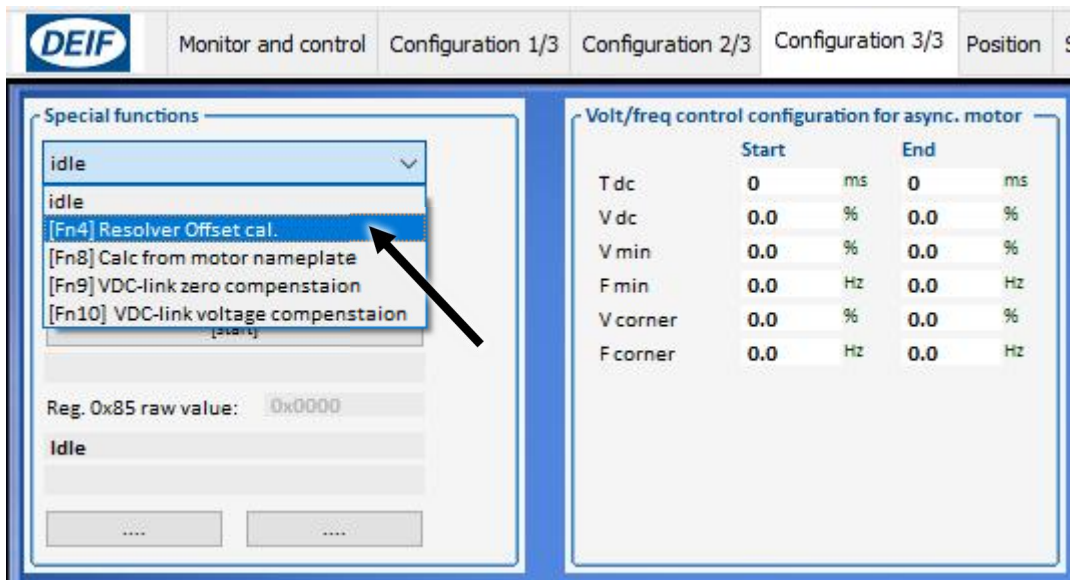
8.6.1.2 Offset determination 偏移量确定

1. Set “RUN” input OFF 设置“RUN”输入 OFF
2. In the IMD Manager “Configuration 2/3” tab, set “N blind safety-run” in the “Safety run” group to approximately 60 RPM. The value is entered as percent of Nmax-100%.

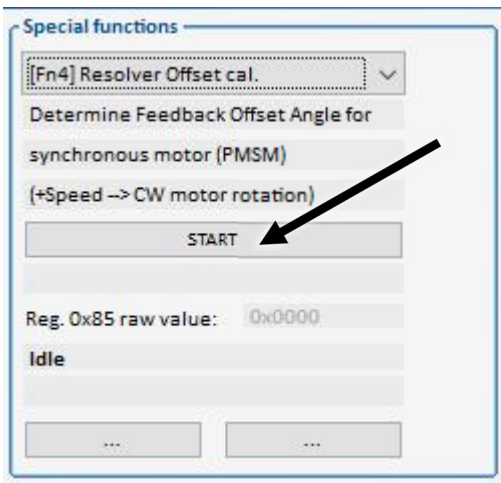
在 IMD 监控软件“配置 2/3”选项卡中，将“安全运行”组中的“N 盲安全运行”设置为大约 60 RPM。该值以 Nmax-100% 的百分比形式输入。



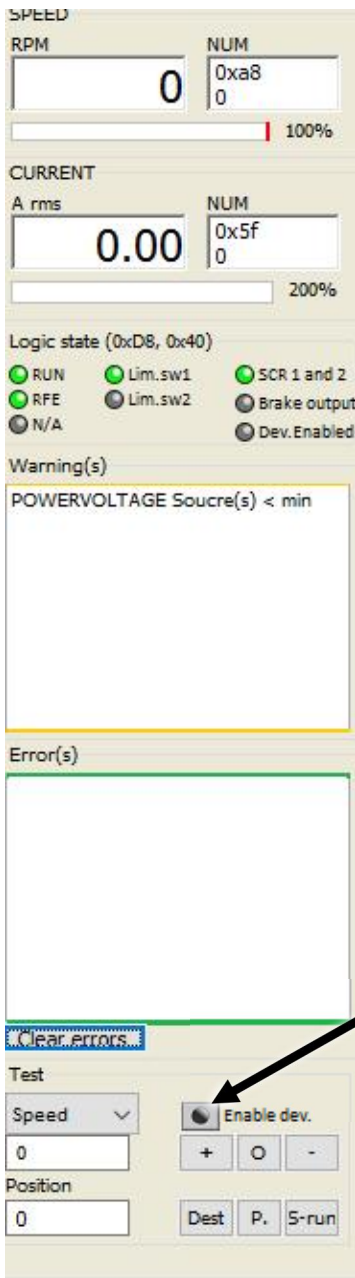
3. Click on the “Configuration 3/3” tab and select “[Fn4] Resolver Offset cal.” in the “Special Functions” dialog box. 点击“配置 3/3”选项卡，在“特殊功能”对话框中选择 “[Fn4] Resolver Offset cal. (编码器偏移校准)”。



4. Set "RUN" input ON. 将 "RUN" 输入设置为 ON。
5. In the "Configuration 3/3" tab press "Start" 在 "配置 3/3" 选项卡中，按下 "开始"



6. Click on “Enable dev.” button to enable the IMD (the icon will turn green when the IMD is enabled).
 点击 “Enable dev” 按钮以启用 IMD（启用 IMD 时图标将变为绿色）



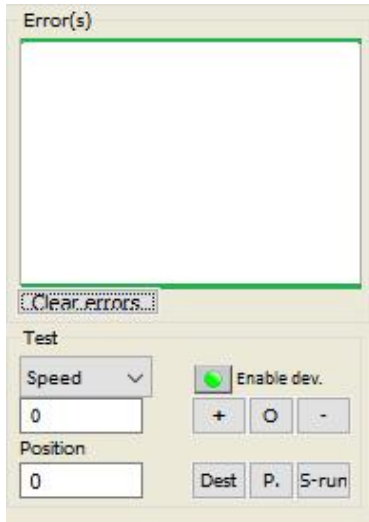
7. The motor will shake a little, and then slowly rotate one revolution. Observe the “RPM” field and verify that the number shown is positive (no “-“ in front of the number). 电机会轻微晃动，然后慢慢旋转一圈。观察 “RPM” 字段并验证显示的数字是否为正（数字前面没有“-”）。



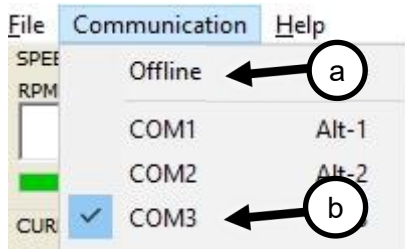
If the number is negative, do the following:如果数字为负数，请执行以下操作：

- If you have not saved the configuration to the EEPROM yet, do it now so you don't lose the configuration made until now (in case the 24 V DC is internal).如果尚未将配置保存到 EEPROM，请立即执行，以免丢失到目前为止所做的配置（如果 24 V DC 在内部）

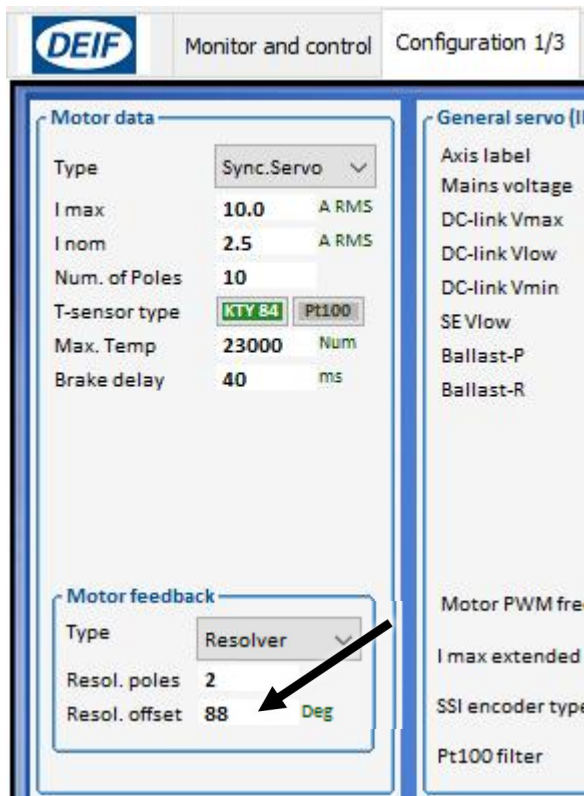
- b. Set "RUN" input OFF 设置 "RUN" 输入为 OFF
 - c. Disconnect the mains power, wait for discharge of the capacitors 断开电源，等待电容器放电
 - d. Swap two phases in the motor cable 交换电机电缆中的两相
 - e. Reconnect mains power and repeat steps 2 (on page 153) to 7 (on page 155 ,this step) 重新连接电源，重复步骤 2（第 117 页）至步骤 7（第 119 页，本步骤）
8. Click on "Enable dev." again to disable the IMD 再次单击 "Enable dev" 以禁用 IMD



9. Update the parameters in the IMD Manager 更新 IMD 监控软件中的参数
- f. Note the used com port (COM3 is shown) and click "Offline" in the "Communication" menu 注意使用的 com 口(图中为 COM3)，在 "Communication" 菜单中点击 "Offline"



- g.
- h. Click on the same COM port used before. The IMD Manager will refresh all values, including the resolver offset: 点击之前使用的 COM 端口。IMD 监控软件将刷新所有值，包括编码器偏移量:



10. Save the configuration to the EEPROM (see IMD Manager user manual).将配置保存到 EEPROM (参见 IMD 监控软件用户手册)。

8.6.2 Configuring additional motor parameters 配置附加电机参数



Attention

If the motor type is **Sync. Servo**, all configurable parameters in “Additional motor parameters” must be set to zero.

注意

如果电机类型为“同步伺服”，“附加电机参数”中的所有可配置参数必须设置为零。

The additional motor parameters are the electrical properties of the motor. There are two ways this can be done:附加电机参数是电机的电气特性。有两种方法可以做到这一点：

- Enter the data from the data sheet manually (if available). If this is done, “L sigma-q” value must be filled before “L sigma-d” value.手动输入数据表中的数据(如果可用)。如果这样做，“L sigma-q”值必须填在“L sigma-d”值之前。
- Use the automatic calculation procedure (calculates the parameter values using data from the name plate).使用自动计算程序(使用铭牌上的数据计算参数值)。

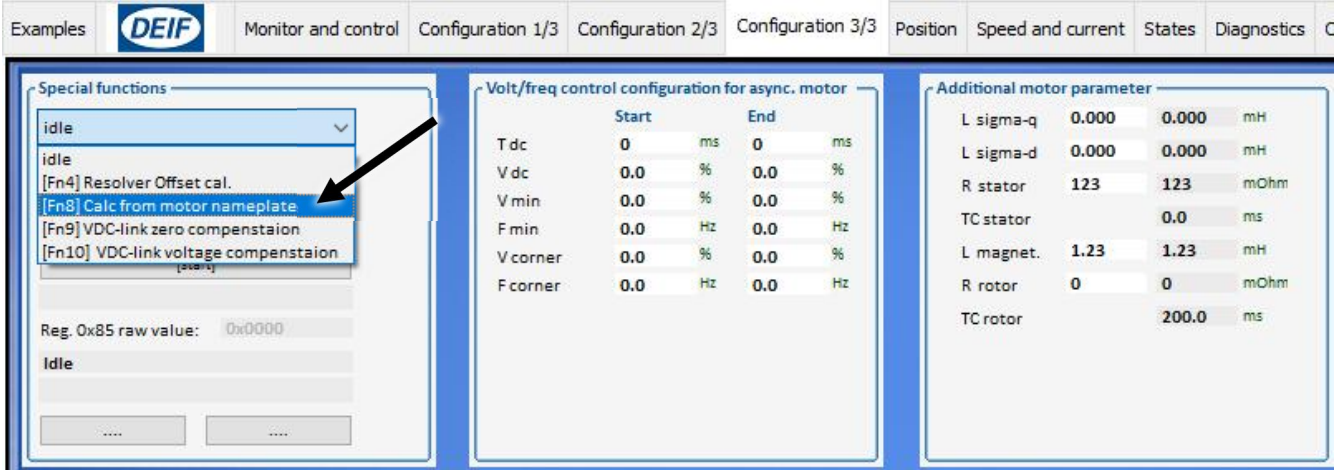
The following procedure describes how to use the automatic calibration procedure.下面介绍如何使用自动校准程序。

8.6.2.1 Prerequisites 先决条件

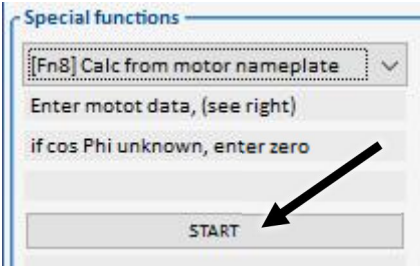
Before configuring the additional parameters all the fields in the “Motor data” group in “Configuration 1/3” tab must be filled.在配置附加参数之前，必须填写“配置 1/3”选项卡中“电机数据”组中的所有字段。

8.6.2.2 Calculation procedure 计算过程

1. Select “[Fn8] Calc from motor nameplate” in the “Special function” group in the “Configuration 3/3” tab. 在“配置 3/3”选项卡的“特殊功能”组中选择 “[Fn8] Calc from motor nameplate”。



2. Click on “START” button 点击“开始”按钮



3. The IMD Manager will now calculate the values and save them in the appropriate registers. The same values are inserted in the Read-only fields (the editable fields are only updated when the IMD Manager connects to the IMD). IMD 监控软件现在将计算这些值并将它们保存在适当的寄存器中。在只读字段中插入相同的值(只有当 IMD 监控软件连接到 IMD 时，可编辑字段才会更新)。

Additional motor parameter			
L sigma-q	0.000	44.178	mH
L sigma-d	0.000	44.178	mH
R stator	123	122	mOhm
TC stator		0.0	ms
L magnet.	1.23	1.23	mH
R rotor	0	0	mOhm
TC rotor		200.0	ms



Info

It is possible to optimize these parameters, which is the reason that editable fields are placed in the same group. Changing the “L magnet” or “R rotor” will change the TC rotor (time constant for rotor). By optimizing TC rotor, it is possible to achieve higher speed with the same load, resulting in less current consumption while in operation.

信息

可以优化这些参数，这就是将可编辑字段放在同一组中的原因。改变“L 磁体”或“R 转子”将改变 TC 转子（转子的时间常数）。通过优化 TC 转子，可以在相同负载下实现更高的速度，从而减少运行时的电流消耗。

8.6.3 Configuring volt/freq control for async. motor 为异步电机配置电压/频率控制

This section is only applicable for asynchronous motors

Some additional voltage and frequency parameters need to be configured when controlling asynchronous motor. These parameters define the voltage/frequency curve generated by the IMD. These are configured in the “Configuration 3/3” tab:

本节仅适用于异步电机

在控制异步电机时，需要配置一些附加的电压和频率参数。这些参数定义了 IMD 产生的电压/频率曲线。这些在“配置 3/3”选项卡中配置：

Configuration 2/3		Configuration 3/3		Position	
Volt/freq control configuration for async. motor					
	Start		End		
T dc	0	ms	0	ms	
V dc	0.0	%	0.0	%	
V min	0.0	%	0.0	%	
F min	0.0	Hz	0.0	Hz	
V corner	0.0	%	0.0	%	
F corner	0.0	Hz	0.0	Hz	

Parameter description:参数说明:

- **Start 开始**
 - **T dc:** DC pre-magnetization time 直流预磁化时间
 - **V dc:** DC pre-magnetization start voltage 直流预磁化启动电压
 - **V min:** Minimum voltage at movement start 移动开始时的最小电压
 - **F min:** Minimum frequency at movement start 移动开始时的最小频率
 - **V corner:** Voltage at rated speed in percentage of the mains input 额定转速下的电压，占电源输入的百分比
 - **F corner:** Frequency at rated voltage. Use motor nominal frequency.额定电压下的频率。使用电机额定频率。
- **End (reserved for future use)结束（保留以备将来使用）**
 - **T dc:** -
 - **V dc:** -
 - **V min:** -
 - **F min:** -
 - **V corner:** -
 - **F corner:** -

8.7 Configuring SE charger parameters (option)配置 SE 充电器参数 (选项)

The SE charger is a hardware option that can be ordered with the IMD. It is not possible to add it later. The charger is an advanced multistage programmable charger, capable of optimised charging for different types of supported energy sources. Refer to the IMD 100 function description for more information about the charger.

SE 充电器是一种硬件选件，可随 IMD 订购。以后无法添加。充电器是一种先进的多级可编程充电器，能够针对不同类型的支持能源进行优化充电。有关充电器的更多信息，请参阅 IMD 100 功能概要。

8.7.1 Charger configuration management 充电器配置管理

Configuration can only be done when the charger is in Setup mode, which is done with a “Setup mode” button in the “SE charger” tab. Charging stops when the charger is in Setup mode, and starts again automatically at the Bulk stage when the Setup mode is disabled.

Like other parameters of the IMD, the charger parameters configuration is done in the values stored in the RAM. As soon as the Setup mode is disabled, it uses the parameter values from the RAM. Like other IMD parameters, any values changed in the RAM, must be saved to EEPROM in order to be used after restart, reset, or load of new parameters. This is done in the “SE charger” tab, see IMD Manager user manual for instructions.

It is also possible to configure the charger by executing a configuration script. The configuration script can set the charger in setup mode configure all parameters, save all parameters to EEPROM and take the charger out of setup mode.

只有在充电器处于设置模式时才能进行配置，设置模式是通过“SE 充电器”选项卡中的“设置模式”按钮完成的。当充电器处于设置模式时，充电停止，当设置模式被禁用时，充电会在 Bulk 阶段自动重新开始。

与 IMD 的其他参数一样，充电器参数配置在 RAM 中存储的值中完成。一旦禁用设置模式，它将使用 RAM 中的参数值。与其他 IMD 参数一样，RAM 中更改的任何值必须保存到 EEPROM 中，以便在重新启动、重置或加载新参数后使用。这是在“SE 充电器”选项卡中完成的，有关说明，请参阅 IMD 监控软件用户手册。

也可以通过执行配置脚本来配置充电器。配置脚本可以将充电器设置为设置模式，配置所有参数，将所有参数保存到 EEPROM，并将充电器退出设置模式。

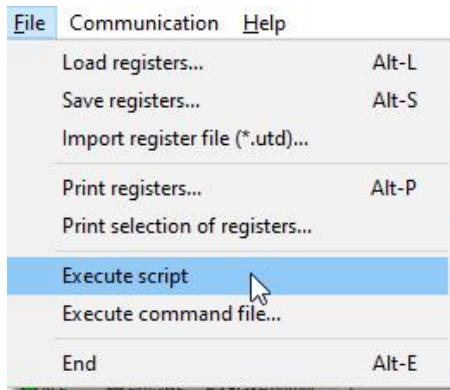
8.7.2 Configuring the charger with a script 使用脚本配置充电器

8.7.2.1 Prerequisites 先决条件

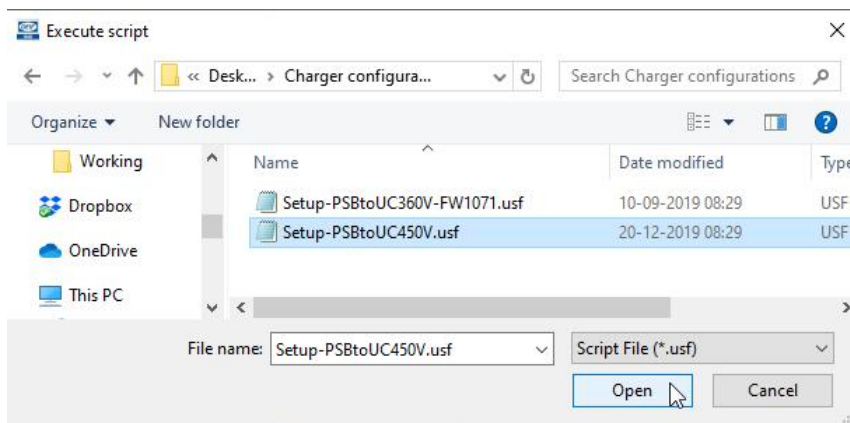
- A configuration script is available 已获取一个配置脚本
- Connect 3x400 V AC to the IMD mains terminals and turn on the power.将 3x400 V AC 连接至 IMD 电源端子并打开电源。
- Connect the PC to the IMD with a USB cable and connect to the drive 使用 USB 电缆将电脑连接到 IMD，然后连接到驱动器


8.7.2.2 Configuring the charger 配置充电器

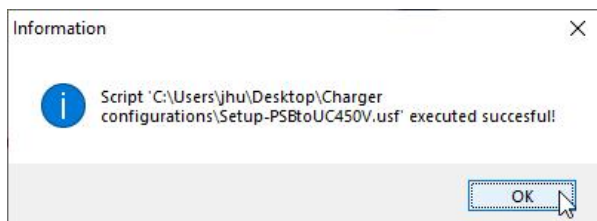
1. Click on File→Exec script:单击 FileExec 脚本:



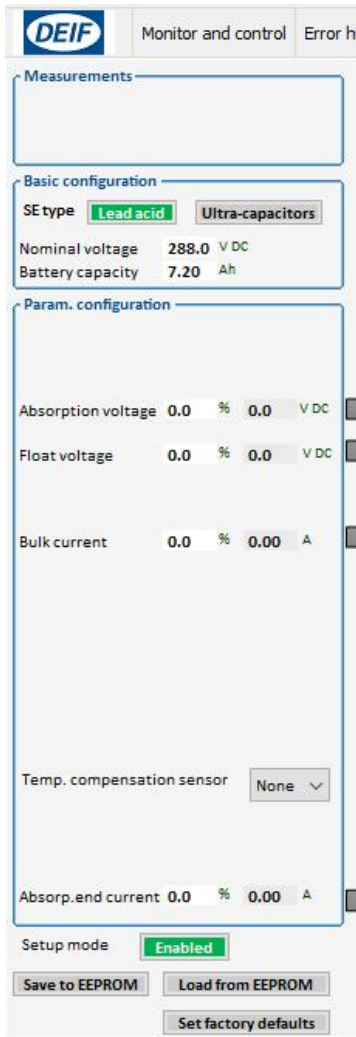
2. Navigate to the folder where the configuration scripts are stored. Select the appropriate configuration and click “Open”: 导航到存储配置脚本的文件夹。选择合适的配置并点击“打开”：



3. The IMD manager executes the script (indicated with a ) When completed, click “OK” in the dialog box: IMD 监控软件执行脚本（用 a 表示）完成后，在对话框中点击“确定”：



4. Click on the “SE charger” tab and verify that the charger is configured as expected: 单击“SE 充电器”选项卡，验证充电器是否按预期配置：



8.7.3 Configuring the charger manually 手动配置充电器


The charger has 2 parameter types: 充电器有两种参数类型:

- **Basic parameters:** Must always be configured. 基本参数: 必须始终配置。
- **Parameter configuration:** Can either be configured manually or used with the factory defaults (select with the “Set factory default” button). There is a set of factory defaults parameters for each SE type. 参数配置: 可以手动配置, 也可以与出厂默认值一起使用 (使用 “设置出厂默认值” 按钮选择)。每个 SE 类型都有一组出厂默认参数。


NOTE To achieve maximum performance and life time of the energy source, consult the energy source supplier, and have the applicable charging characteristics at hand.

说明为了使电源的性能和使用寿命达到最大, 请咨询电源供应商, 并掌握适用的充电特性。

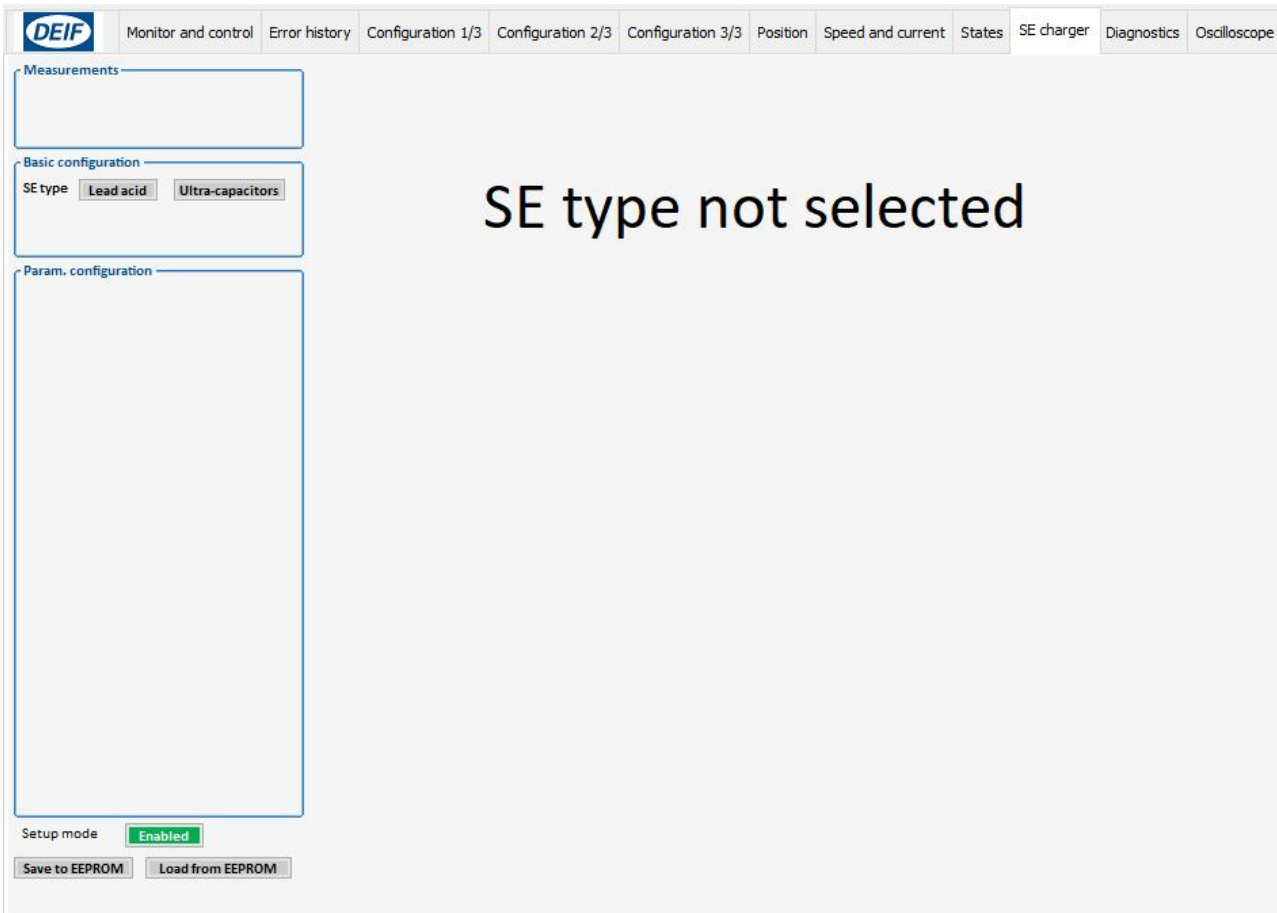
8.7.3.1 Configuring type and basic configuration 配置类型和基本配置

1. Click on the “SE charger” tab. If the Setup mode is disabled () click on the “Disabled” button to enable the Setup mode.

The following screen shows the tab when the charger is not configured:

1. 单击 “SE 充电器” 选项卡。如果设置模式已被禁用 (), 请单击 “禁用” 按钮以启用设置模式。

未配置充电器时，界面显示如下：



2. In the “Basic configuration” group, click on the SE type used:在“基本配置”组中，点击使用的 SE 类型：



When the SE type is selected, the area on the right-side changes to the charging curve applicable for the selected SE type, and the relevant parameters are shown on the left-side.

当选择 SE 类型时，右侧区域将更改为适用于所选 SE 类型的充电曲线，相关参数显示在左侧。

3. Enter the nominal voltage of the used SE source (the sum of all elements' nominal voltage):
输入所用 SE 电源的标称电压（所有元件标称电压之和）：

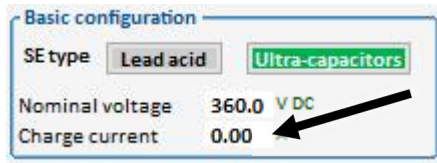


NOTE Resolution in any voltage setting is 100 mV. This applies to all voltage charge values.

注：任何电压设置的分辨率均为 100 mV。这适用于所有电压电荷值。

4. Enter the charge current parameter value. This value is the 100% current value. All other current parameters' values are defined as percentage of this value.

输入充电电流参数值。该值为 100% 电流值。所有其他当前参数的值被定义为该值的百分比。



NOTE Resolution in any current setting is 10 mA. This applies to all current charge values. If this or any resulting current is above 5 A, the charger will use 5 A.

注：任何电流设置下的分辨率均为 10 mA。这适用于所有当前电荷值。如果此电流或任何产生的电流高于 5 A，充电器将使用 5 A。

5. According to the selected SE type, go to the applicable step:根据所选 SE 类型，进入适用步骤:

- a. Lead acid: Section [8.7.3.2](#) on page [166](#)

铅酸：第 126 页上的第 8.7.3.2 节

- b. Lithium Ion: Section [8.7.3.4](#) on page [170](#)

锂离子：第 129 页上的第 8.7.3.4 节

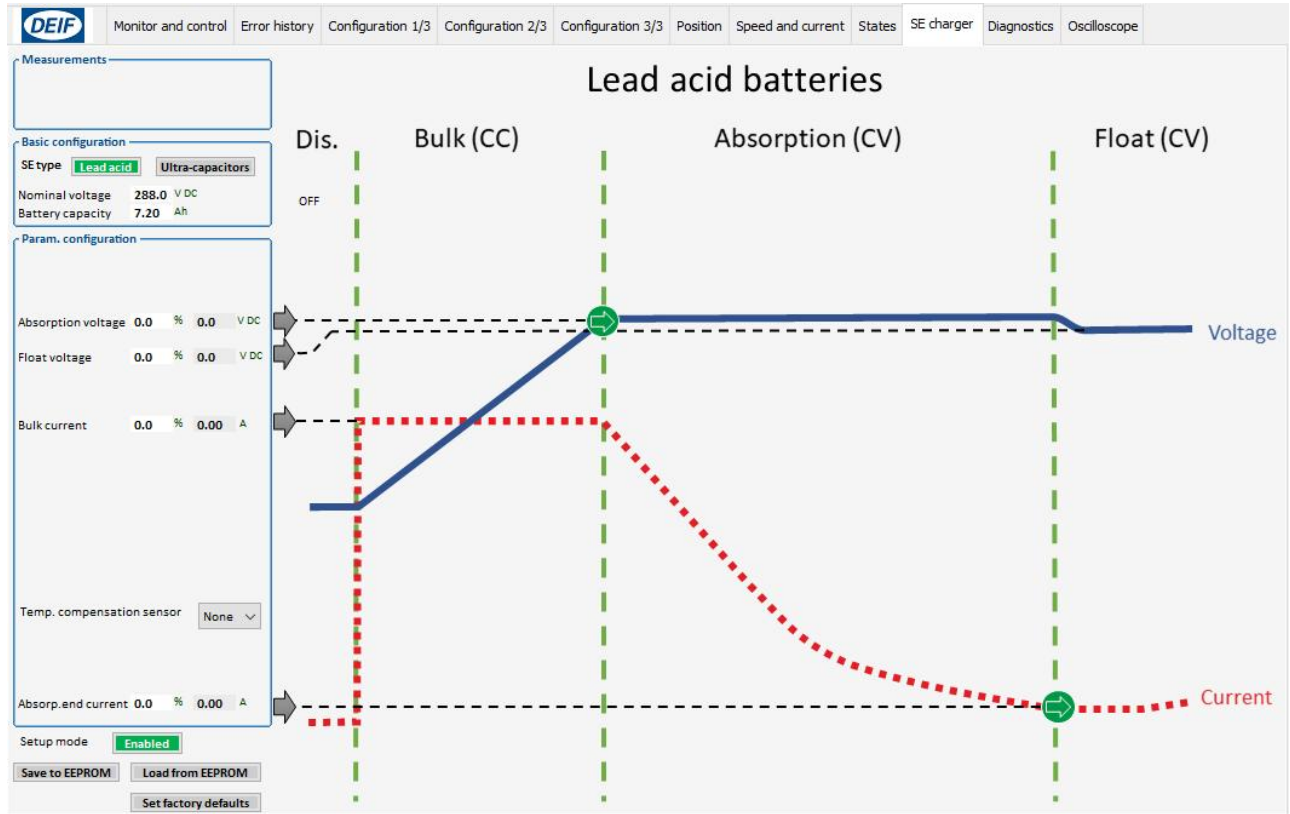
- c. Ultra-capacitor: Section [8.7.3.3](#) on page [168](#)

超级电容器：第 128 页上的第 8.7.3.3 节

NOTE When entering a value in percent, the resulting voltage in Volt or current in Ampere, will be shown after hitting "Enter" or moving the cursor to another field. There is no restraint on the percentage values (may be above 100%).

注意 输入百分比值时，按 "Enter" 或将光标移动到另一个字段后，将显示以伏特为单位的电压或以安培为单位的电流。百分比值没有限制（可能高于 100%）。

8.7.3.2 Configuration of Lead acid SE type parameters: 铅酸 SE 类型参数的配置:



Lead acid charging process: 铅酸充电过程:

- Bulk stage: Charging starts in Bulk stage with constant current (*Bulk current*). The Bulk stage continues until the voltage reaches *Absorption voltage*, and the charger goes to absorption stage. Bulk 阶段: 在 Bulk 阶段以恒定电流 (Bulk 电流) 开始充电。Bulk 阶段继续, 直到电压达到吸收电压, 充电器进入吸收阶段。
- Absorption stage: Charging is done with constant voltage (*Absorption voltage*) until the current drops to *Absorp.end current*, and the charger goes to float stage. 吸收阶段: 以恒定电压 (吸收电压) 进行充电, 直到电流降至吸收端电流, 充电器进入浮充阶段。
- Float stage: This is the final stage. Charging is done with constant voltage (*Float voltage*). 浮充阶段: 这是最后阶段。充电是通过恒压 (浮充电压) 完成的。

1. Enter the “Absorption voltage” in percentage (with one decimal) of the “Nominal voltage”: 以 “标称电压” 的百分比 (带一位小数) 输入 “吸收电压”: Absorption voltage 0.0 % 0.0 V DC
When the value of this parameter is reached, the charger goes from Bulk to Absorption stage, and keep charging with this value as constant voltage. 当达到该参数值时, 充电器从 Bulk 阶段进入吸收阶段, 并以该值作为恒压持续充电。
2. Enter the “Float voltage” in percentage (with one decimal) of the “Nominal voltage”: 输入 “浮充电压” 占 “标称电压” 的百分比 (带一位小数): Float voltage 0.0 % 0.0 V DC
This voltage is used as constant voltage in the Float stage. 该电压用作浮充阶段中的恒定电压。
3. Enter the “Bulk current” in percentage (with one decimal) of the “Charge current”: 输入 “充电电流” 的百分比 (带一位小数): Bulk current 0.0 % 0.00 A
This current is used as constant current in the Bulk stage. 该电流在 Bulk 阶段用作恒定电流。

4. Select the temperature compensation sensor:选择温度补偿传感器:



None: No temperature compensation.

Pt1: The charger compensates the voltage according to the battery temperature (+3 mV/cell/°C when the temperature is below 25 °C, and -3 mV/cell/°C when the temperature is above 25 °C). The number of cells is calculated from the nominal voltage. The compensated voltage is not indicated in the configured parameters on the left side.

When a temperature sensor is selected, the charger will generate a warning if the battery temperature is below -30 °C or above 60 °C.

If a temperature sensor is selected, the temperature value is shown in both “Measurements” group in the “SE charger” tab, and in the “SE charger” group in the “Monitor and control” tab.

4.无: 无温度补偿。

Pt1: 充电器根据蓄电池温度补偿电压（温度低于 25° C 时为+3 mV/cell/° C，温度高于 25° C 时为-3 mV/cell/° C）。根据标称电压计算电池数量。左侧的配置参数中未显示补偿电压。

选择温度传感器后，如果蓄电池温度低于-30° C 或高于 60° C，充电器将发出警告。

如果选择了温度传感器，“SE 充电器”选项卡中的“测量”组和“监控”选项卡中的“SE 充电器”组都会显示温度值。



5. Enter the “Absorp.end current” in percentage (with one decimal) of the “Charge current”:

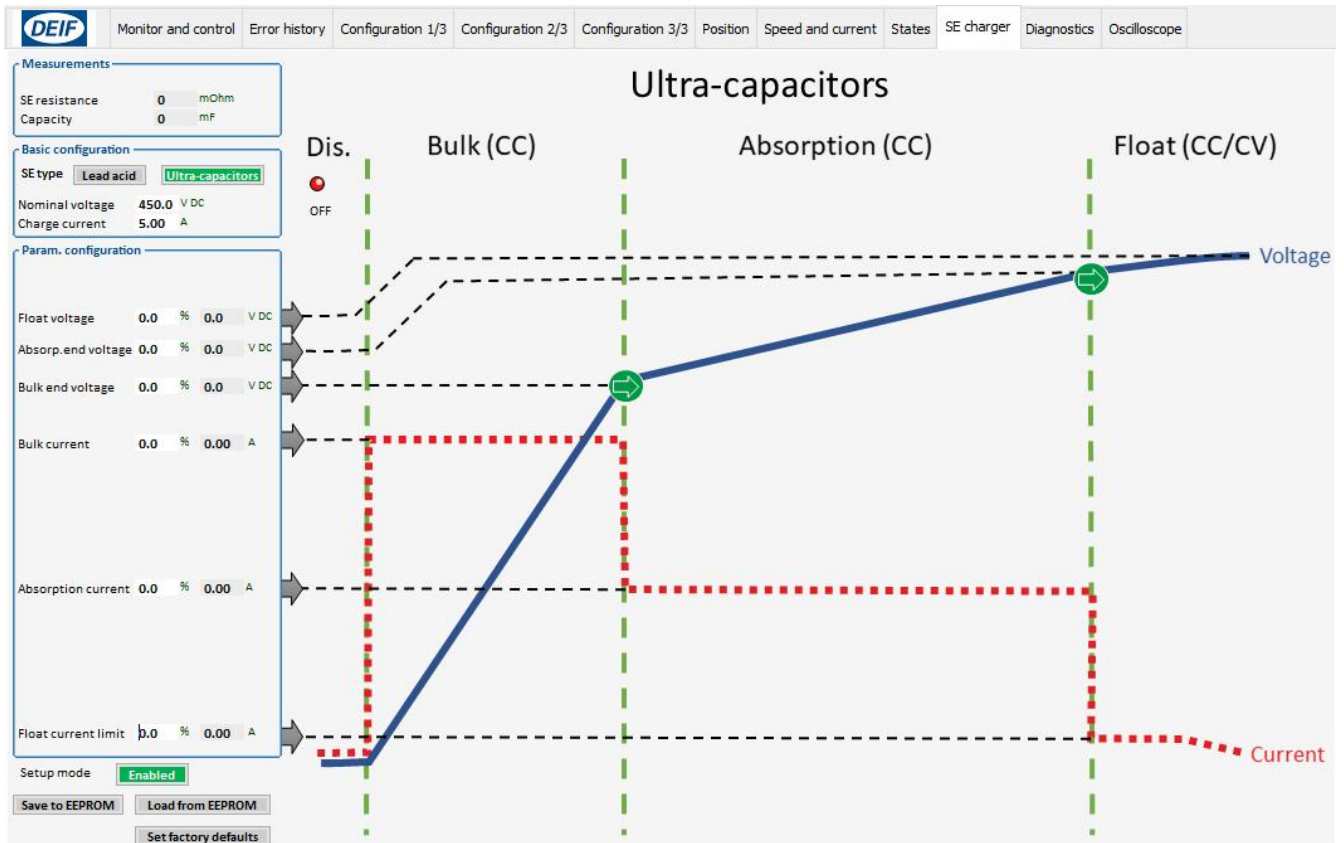
Absorp.end current 0.0 % 0.00 A

When the value of this parameter is reached, the charger goes from Absorption to Float stage.

以“充电电流”的百分比（带一位小数）输入“吸收端电流”：

当达到该参数的值时，充电器从吸收阶段进入浮充阶段。

8.7.3.3 Configuration of Ultra-capacitor SE type parameters (available on request): 超级电容器 SE 型参数配置 (可根据要求提供) :



Ultra-capacitors charging process: 超级电容充电过程:

- Bulk stage: Charging starts in Bulk stage with constant current (*Bulk current*). The Bulk stage continues until the voltage reaches *End voltage*, and the charger goes to absorption stage.
Bulk 阶段: 在 Bulk 阶段以恒定电流 (Bulk 电流) 开始充电。Bulk 阶段一直持续到电压达到 终端电压, 充电器进入吸收阶段。
- Absorption stage: Charging is done with constant current (*Absorption current*) until the voltage reaches *Absorp.end voltage*, and the charger goes to float stage. 吸收阶段: 以恒定电流 (吸收电流) 进行充电, 直到电压达到吸收端电压, 充电器进入浮充阶段。
- Float stage: This is the final stage. Charging is done with current limit (*Float current limit*) and voltage limit (*Float voltage*). The stage starts with *Float current limit* until the voltage reaches *Float voltage*. Charging is then continued with *Float voltage*. 浮充阶段: 这是最后一个阶段。充电通过电流限制 (浮动电流限制) 和电压限制 (浮动电压) 完成。该级以浮动电流限制开始, 直到电压达到浮动电压。然后使用浮动电压继续充电。

1. Enter the "Float voltage" in percentage (with one decimal) of the "Nominal voltage":

Float voltage 0.0 % 0.0 V DC

This voltage is used as a voltage limit in the Float stage.

以“标称电压”的百分比 (带一位小数) 输入“浮动电压”:

该电压用作浮充阶段的电压限制。

2. Enter the "Absorp. end voltage" in percentage (with one decimal) of the "Nominal voltage":

Absorp.end voltage 0.0 % 0.0 V DC

When the value of this parameter is reached, the charger goes from Absorption stage to Float stage.

以“标称电压”的百分比（带一位小数）输入“吸收端电压”：

当达到该参数的值时，充电器从吸收阶段进入浮充阶段。

3. Enter the “End voltage” in percentage (with one decimal) of the “Nominal voltage”:

End voltage 0.0 % 0.0 VDC

When the value of this parameter is reached, the charger goes from Bulk to Absorption stage.

以“标称电压”的百分比（带一位小数）输入“终端电压”：

当达到此参数的值时，充电器从 Bulk 进入吸收阶段。

4. Enter the “Bulk current” in percentage (with one decimal) of the “Charge current”:

Bulk current 0.0 % 0.00 A

This current is used as constant current in the Bulk stage.

以“充电电流”的百分比（带一位小数）输入“充电电流”：

该电流在 Bulk 阶段中用作恒定电流。

5. Enter the “Absorption current” in percentage (with one decimal) of the “Charge current”:

Absorption current 0.0 % 0.00 A

This current is used as constant current in the Absorption stage.

以“充电电流”的百分比（带一位小数）输入“吸收电流”：

该电流在吸收阶段用作恒定电流。

6. Enter the “Float current limit” in percentage (with one decimal) of the “Charge current”:

Float current limit 0.0 % 0.00 A

This current is used as current limit in the float stage.

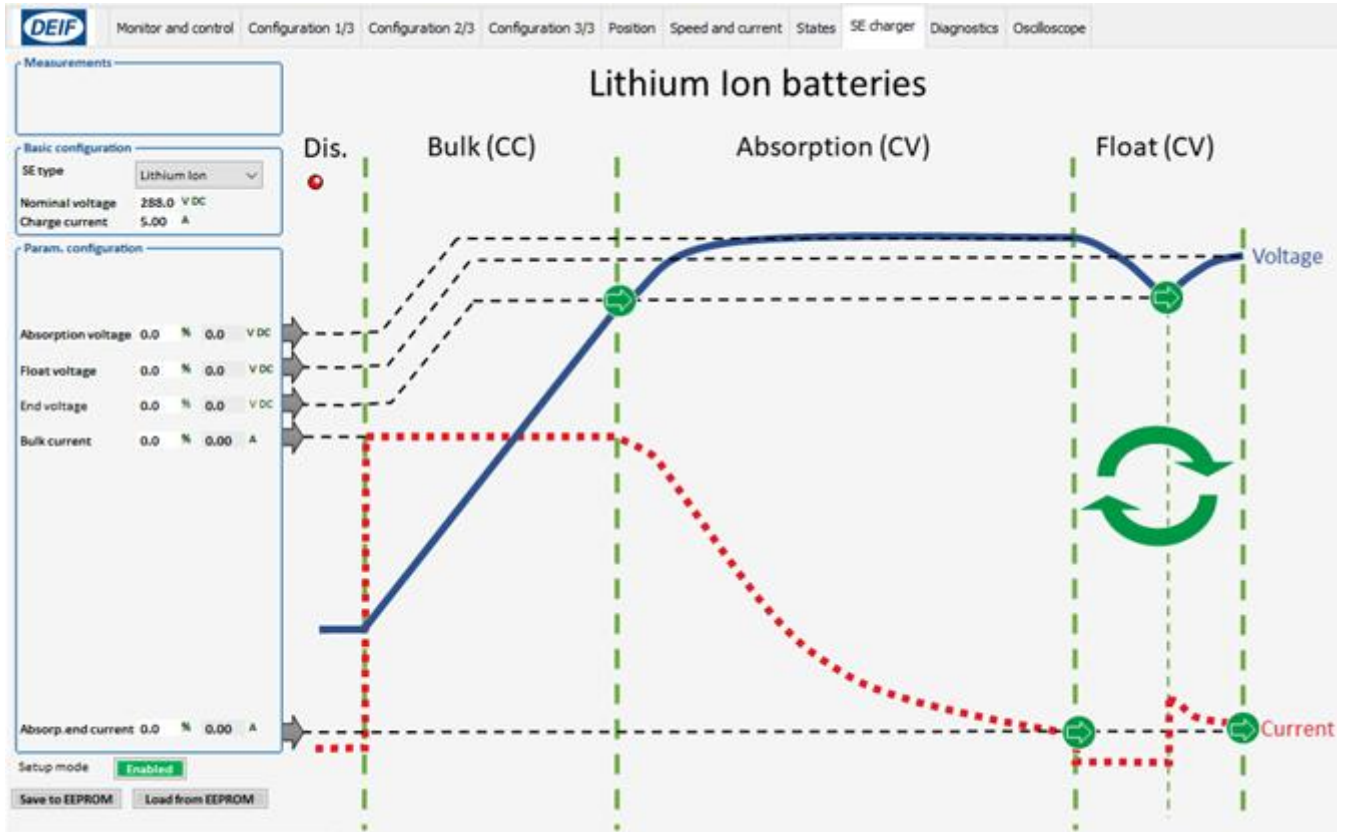
以“充电电流”的百分比（小数点后一位）输入“浮动电流限值”：

该电流在浮充阶段用作电流限制。

NOTE Both voltage and current are limits in the Float stage. In the beginning of the stage the current limit is active until the voltage limit is reached, after which, the voltage limit will be active.

注：电压和电流都是浮充阶段的限值。在该阶段开始时，电流限制处于激活状态，直到达到电压限制。之后，电压限制将处于激活状态。

8.7.3.4 Configuration of Lithium Ion SE type parameters: 锂离子 SE 型参数配置:



Lithium Ion charging process: 锂离子充电过程:

- Bulk stage:** Charging starts in Bulk stage with constant current (*Bulk current*). The Bulk stage continues until the voltage reaches *End voltage*, and the charger goes to absorption stage.

Bulk 阶段: 在 Bulk 阶段以恒定电流 (Bulk 电流) 开始充电。Bulk 阶段一直持续到电压达到终端电压, 充电器进入吸收阶段。
- Absorption stage:** Charging is done with constant voltage (*Absorption voltage*) until the current drops to *Absorp.end current*, and the charger goes to float stage.

吸收阶段: 以恒定电压 (吸收电压) 进行充电, 直到电流降至吸收端电流, 充电器进入浮充阶段。
- Float stage:** This is the final stage. Charging is stopped until SE voltage drops to *End voltage*, that causes restart of charging with constant voltage (*Float voltage*). When the charge current drops to *Absorp.end current* the charging is stopped again. This cycle continues as long as the charger is in the float stage.

浮充阶段: 这是最后一个阶段。充电停止, 直到 SE 电压降至端电压, 从而导致以恒定电压 (浮动电压) 重新开始充电。当充电电流降至吸收端电流时, 充电再次停止。只要充电器处于浮动阶段, 该循环就会持续。

1. Enter the “Absorption voltage” in percentage (with one decimal) of the “Nominal voltage”:

Absorption voltage 0.0 % 0.0 V DC

This value is used as constant voltage value during the Absorption stage.

以“标称电压”的百分比 (带一位小数) 输入“吸收电压”:

该值在吸收阶段用作恒定电压值。

2. Enter the “Float voltage” in percentage (with one decimal) of the “Nominal voltage”:

Float voltage 0.0 % 0.0 V DC

This voltage is used as constant voltage in the Float stage. It is possible to use the same value as the “Absorption voltage”.

以“标称电压”的百分比（带一位小数）输入“浮动电压”：

该电压用作浮动阶段中的恒定电压。可以使用与“吸收电压”相同的值。

3. Enter the “End voltage” in percentage (with one decimal) of the “Nominal voltage”:

End voltage 0.0 % 0.0 V DC

When the value of this parameter is reached, the charger goes from Bulk to Absorption stage, as well as for transition from rest (no charge) to charge in the float stage.

以“标称电压”的百分比（带一位小数）输入“结束电压”：

当达到此参数的值时，充电器从 Bulk 阶段进入吸收阶段，并在浮充阶段从静止（不充电）过渡到充电。

4. Enter the “Bulk current” in percentage (with one decimal) of the “Charge current”:

Bulk current 0.0 % 0.00 A

This current is used as constant current in the Bulk stage.

以“充电电流”的百分比（带一位小数）输入“Bulk 电流”：

该电流在 Bulk 阶段用作恒定电流。

5. Enter the “Absorp. end current” in percentage (with one decimal) of the “Charge current”:

Absorp.end current 0.0 % 0.00 A


When the value of this parameter is reached, the charger goes from Absorption to Float stage, as well as from charge to rest (no charge) in the float stage.

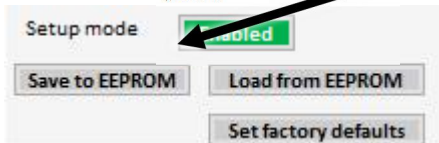
以“吸收端电流”的百分比（带一位小数）输入“充电电流”：

当达到该参数的值时，充电器从吸收阶段进入浮充阶段，并从充电阶段进入静止状态（不充电）。

8.7.3.5 Completing the configuration 完成配置

Perform one of the two:执行以下两种操作之一：

- To start the charger with the configured parameters without saving to EEPROM: Click on “Setup mode” button (). The running configuration can be saved later. 使用配置的参数启动充电器而不保存到 EEPROM：单击“设置模式”按钮 ()。运行配置可以稍后保存。
- To save the configuration click on “Save to EEPROM” button:要保存配置，请点击“保存到 EEPROM”按钮：



9. Operational procedures 操作程序

This section describes operational procedures which can be executed either by using the IMD Manager or the CAN/CANopen interface.

本节描述了可以通过 IMD 监控软件或 CAN /CANopen 接口执行的操作步骤。

9.1 Brake test 制动测试

It is possible to manually test the brake output in order to verify that the brake is released and the motor can turn. Activating the brake test is done by using function 08 in the special commands.

可以手动测试制动器输出，以确认制动器已释放且电机可以转动。使用特殊命令中的功能 08 激活制动器测试。

9.1.1 Prerequisites 先决条件

The IMD must be in Normal operation state, and the Device must be disabled (reg. 0x51 bit 2 = 1).

IMD 必须处于正常操作状态，并且设备必须被禁用（reg.0x51 位 2=1）。

9.1.2 Activation 激活

IMD Manager: Select “8:Brake test” in the “States and special commands” in the “Monitor and control” tab.

IMD 监控软件：在“监控”选项卡的“状态和特殊命令”中选择“8：制动测试”。

States and special commands	
IMD state	1 Normal Operation
Special commands	0: Idle
Special commands feedback	0: Idle 2: Pre-heating 3: SE-test, initiate 4: Position preset 5: SE-test, PWM load ON 6: SE-test, load OFF 7: Store position 8: Brake test ON 12: Mains, disconnect 13: Mains, connect 14: Trip SCR output 15: SE-test, single pulse load ON
Temperatures	
Pt1 (Pt100)	1231
Pt2 (Pt100)	1395
Pt3 (Pt100)	1408
Pt4 (Pt100)	1756

CAN/CANopen: send “8” to the special commands register (reg. 0x03)

The IMD changes state to 40 – “Brake test”, turns the brake output (X2) on, and changes the “Brake output” LED indication in the IMD Manager to on.

CAN/CANopen: 将“8”发送到特殊命令寄存器（reg.0x03）

IMD 将状态更改为 40- “制动测试”，打开制动输出（X2），并将 IMD 监控软件中的“制动输出” LED 指示灯更改为打开。

9.1.3 Operation 操作

The IMD will remain in this state until “0” (Idle) is sent to special commands register (reg. 0x03).

It is not possible to use the “Enable dev.” button or enable the device through CAN while the IMD is in brake test.

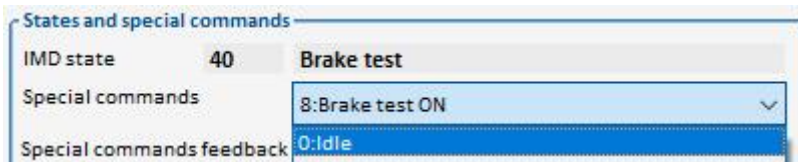
IMD 将保持这种状态，直到 “0” (Idle)被发送到特殊命令寄存器(reg.0 x03)。

IMD 正在进行制动测试时，不能使用 “Enable dev.” 按钮或通过 CAN 启用设备。

9.1.4 Deactivation 停用

IMD Manager: Select “0:Idle” in the “States and special commands” in the “Monitor and control” tab.

IMD 监控软件：在 “监控” 选项卡的 “状态和特殊命令” 中选择 “0:Idle” 。



CAN/CANopen: send “0” to the special commands register (reg. 0x03).

The IMD goes back to “Normal operation” state, turns the brake output (X2) off, and changes the “Brake output” LED indication in the IMD Manager to off.

CAN/CANopen: 将 “0” 发送到特殊命令寄存器 (reg. 0x03) 。

IMD 返回 “正常操作” 状态，关闭制动器输出 (X2)，并将 IMD 监控软件中的 “制动器输出” LED 指示灯更改为关闭。

9.2 Changing actual position value (Pos. preset)更改实际位置值 (位置预设)

It is possible to change the value of the actual position value. The position is a 32 bits value where the low 16 bits indicates the position of the motor within one revolution. The high 16 bits indicates the number of revolutions. This function is normally used to reset the revolution counter to zero, when using speed profile for safety run, or calibrating zero revolutions for use with the Virtual limit switches (VLMS).

The following figure shows how the actual position is changed when the position is changed to zero (in both “Position” and “Monitor and control” tabs):

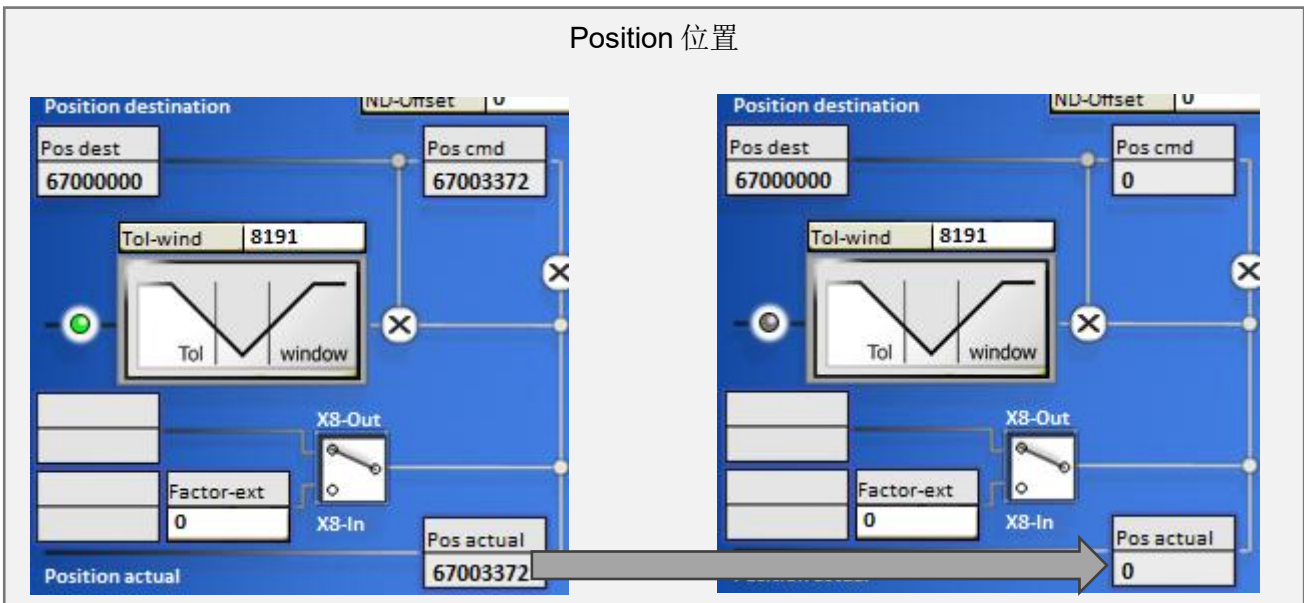
可以改变实际位置值的值。该位置是一个 32 位值，其中低 16 位表示电机在一转内的位置。高 16 位表示转数。当使用速度配置文件进行安全运行或校准与虚拟限位开关 (VLM) 一起使用的零转数时，此功能通常用于将转数计数器重置为零。

下图显示了当位置更改为零时（在 “位置” 和 “监控” 选项卡中），实际位置是如何更改的：

Monitor and control 监控

Actual position			
	Reg. value	Revolution pos.	No. of Revolutions
SSI encoder	4091987	83	999
Resolver	67003372	25580	1022

Actual position			
	Reg. value	Revolution pos.	No. of Revolutions
SSI encoder	4091988	84	999
Resolver	0	0	0



9.2.1 Prerequisites 先决条件

The IMD must be in Normal operation state, and the Device must be disabled (Reg. 0x51 bit 2 = 1).

IMD 必须处于正常操作状态，并且设备必须被禁用（Reg.0x51 位 2=1）。

9.2.2 Activation 激活

IMD Manager: Select “4: Pos. preset” in the “States and special commands” in the “Monitor and control” tab. **IMD 监控软件:** 在“监控”选项卡的“状态和特殊命令”中选择“4：位置预设”。

States and special commands		
IMD state	1	Normal Operation
Special commands	0: Idle	
Special commands feedback	0: Idle	
	2: Pre-heating	
	3: SE-test, initiate	
	4: Position preset	
	5: SE-test, PWM load ON	
	6: SE-test, load OFF	
Temperatures		
Pt1 (Pt100)	1231	

CAN/CANopen: send “4” to the special commands register (Reg. 0x03)

The IMD changes to state 35 – “Pos. preset”.

CAN/CANopen: 将 “4” 发送到特殊命令寄存器 (Reg.0x03)

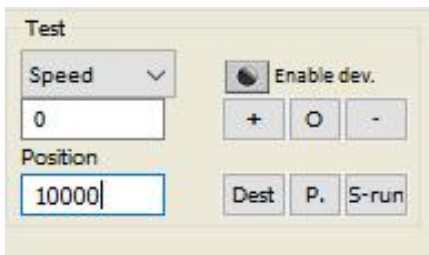
IMD 更改为状态 35- “位置预设”。

9.2.3 Operation 操作

It is now possible to change the actual position value. 现在可以改变实际的位置值。

IMD Manager: Enter the desired value in the “Position” field. The value must be a 32 bits value which can be entered in decimals (max 4294967295) or Hexadecimals (max 0xFFFFFFFF).

IMD 监控软件：在 “位置” 字段中输入所需的值。该值必须是 32 位值，可以以十进制（最大 4294967295）或十六进制（最大 0xFFFFFFFF）输入。



1. Click on the “P.” button 点击 “P” 按钮
2. The new value is now used as actual position. 新值现在用作实际位置。

CAN/CANopen: write the desired value to 0x7A 将所需值写入 0x7A

9.2.4 Deactivation 停用

IMD Manager: Select “0:Idle” in the “States and special commands” in the “Monitor and control” tab. IMD 监控软件：在 “监控” 选项卡的 “状态和特殊命令” 中选择 “0:Idle”。



CAN/CANopen: send “0” to the special commands register (Reg. 0x03). The IMD goes back to “Normal operation” state. 将 “0” 发送到特殊命令寄存器 (Reg. 0x03)。IMD 返回到 “正常操作” 状态。

9.3 Disconnecting AC mains from DC-link (Mains, disconnect) 从直流母线断开交流电源 (电源, 断开)

It is possible to disconnect the AC mains supply from the DC-link internally in the IMD (it has no effect on safe energy). 可以在 IMD 内部断开交流电源与直流母线的连接 (这对后备电源没有影响)。



Info

This function is not supported in IMD 100 A version
 信息
 IMD 100 A 版本不支持此功能



Attention

After executing “Mains, disconnect” command, safe energy is the only power source until “Mains, connect” command is executed.

“Mains, disconnect” also cancels the LVRT timer if it is active.

注意

在执行“电源，断开”命令后，直到“电源，连接”命令执行之前，后备电源是唯一的电源。

如果 LVRT 定时器处于激活状态，“电源，断开连接”也会取消 LVRT 定时器。

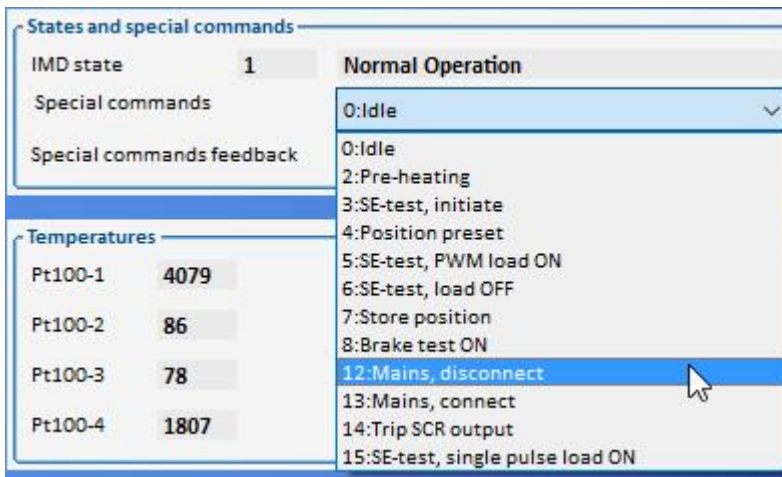
9.3.1 Prerequisites 先决条件

- SE Vlow warning is not active SE Vlow 警告未激活

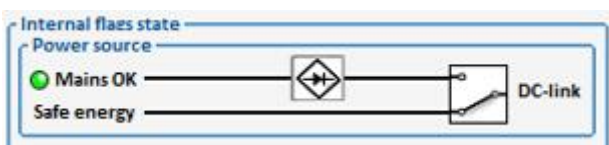
9.3.2 Activation 激活

IMD Manager: Select “12:Mains, disconnect” in the “States and special commands” in the “Monitor and control” tab.

IMD 监控软件：在“监控”选项卡中的“状态和特殊命令”中选择“12：电源，断开”。



The indication in the “Power source” group in the “Monitor” tab will change to show that the Mains is the energy source of the DC-link (will also change if the command is executed through CAN/CANopen): “监视”选项卡中“电源”组中的指示将改变，以显示主电源是直流母线的能源（如果通过 CAN/CANopen 执行命令，也将改变）



CAN/CANopen: send “12” to the special commands register (reg. 0x03)

The IMD remains in state 1 – “Normal operation” and disconnects the AC mains from the DC-link. The flag “Mains, disconnect” changes from 0 to 1.

CAN/CANopen: 将 “12” 发送到特殊命令寄存器 (reg.0x03)

IMD 保持状态 1- “正常操作”，并断开交流电源与直流母线的连接。“电源，断开”标志从 0 变为 1。

9.3.3 Operation 操作

After the “Mains, disconnect” command is executed, the Mains stays disconnected, and the IMD is using the safe energy. The IMD will not reconnect the mains automatically unless a safety run is performed, and the DC-link voltage is below DC-link Vlow.

Sending “0” to the special commands register (reg. 0x03) will not reconnect the AC mains supply to the DC-link.

执行“电源，断开”命令后，电源保持断开状态，IMD 使用后备电源。除非执行安全运行，且直流母线电压低于直流母线 Vlow，否则 IMD 不会自动重新连接电源。

将“0”发送到特殊命令寄存器 (reg. 0x03) 将不会将交流电源重新连接到直流母线。

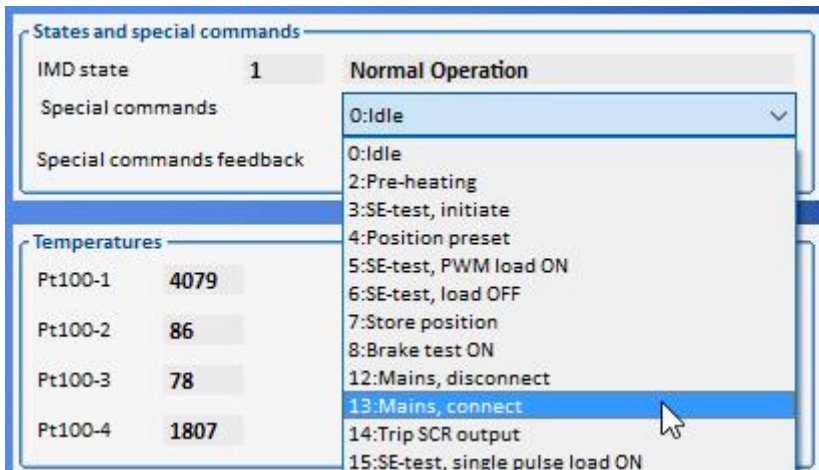
9.3.4 Deactivation 停用

NOTE The Mains must be in OK state to be able to reconnect the Mains.

IMD Manager: select “13:Mains, connect” in the “States and special commands” in the “Monitor and control” tab.

注：电源必须处于正常状态，才能重新连接电源。

IMD 监控软件：在“监控”选项卡的“状态和特殊命令”中选择“13：电源，连接”。



The indication in the “Power source” group in the “Monitor” tab will change to show that the Mains is the energy source of the DC-link (will also change if the command is executed through CAN/CANopen):

“监视器”选项卡中“电源”组中的指示将改变，以显示主电源是直流母线的能源来源（如果通过 CAN/CANopen 执行命令，也将改变）：



CAN/CANopen: send “13” to the special commands register (reg. 0x03). The IMD reconnects the AC mains to the DC-link. The flag “Mains, disconnect” changes from 1 to 0.

CAN/CANopen: 将“13”发送到特殊命令寄存器（reg. 0x03）。IMD 将交流电源重新连接到直流母线。“电源，断开”标志从 1 变为 0。

9.4 Enabling the power module 启用电源模块

The power module (IGBT) requires several signals to be enabled. 电源模块（IGBT）需要启用多个信号。

- HW inputs:硬件输入
 - RFE (X9-1) digital input must be high 数字输入必须为高
 - RUN (X9-2) digital input must be high 数字输入必须为高
- SW control:软件控制
 - “Enable off” bit (bit 2) in register 0x51 must be set to zero in one of the following ways:
寄存器 0x51 中的“Enable off”位(2 位)必须通过以下方式之一设置为 0:
 - Writing zero in the register 向寄存器中写入 0
 - Clicking on the “Enable dev.” button in the IMD Manager (pos.1), 点击 IMD 监控软件（位置 1）中的“Enable dev”按钮，
 - Sending CANopen command “not enable off” (the register value is inverted). 发送 CANopen 命令“not enable off”（寄存器值取反）

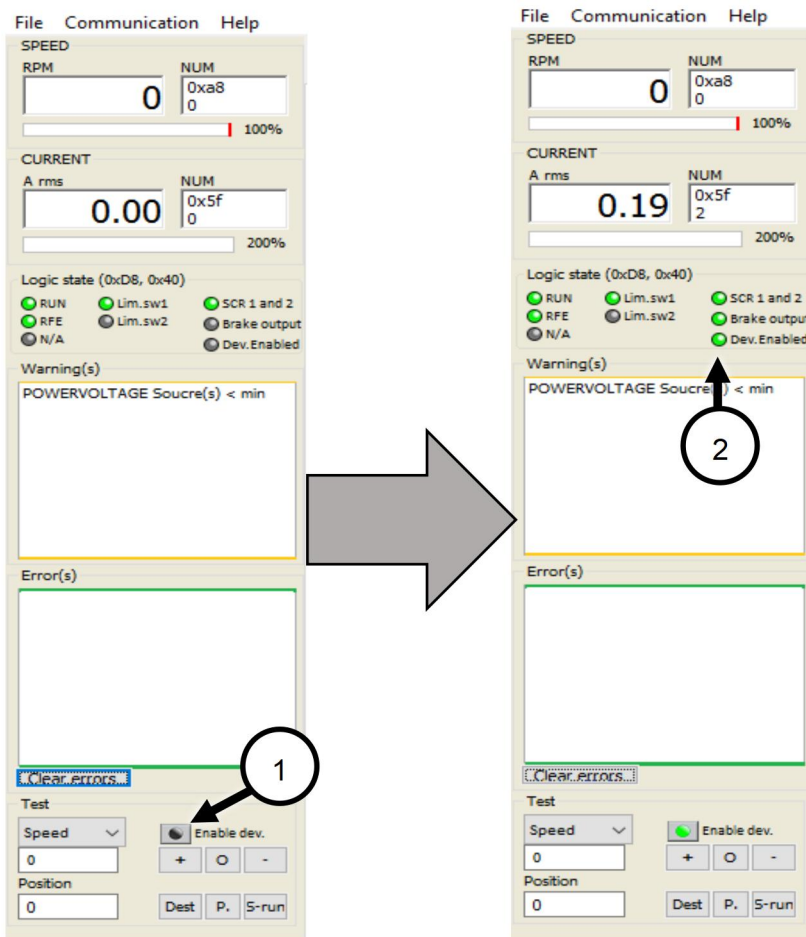
The state of this bit can be monitored by the “Enable dev.” LED in the IMD Manager or by reading register 0x51. Note that this bit is inverted:

该位的状态可通过 IMD 监控软件中的“Enable dev”指示灯或读取寄存器 0x51 进行监控。请注意，此位是反向的：

Enable off = 0: device is enabled 表示设备已启用

Enabled off = 1: device is disabled 表示设备已关闭

The state of the power module can be monitored by the “Dev.Enabled” LED in the IMD Manager (pos.2):电源模块的状态可以通过 IMD 监控软件（位置 2）中的“Dev.Enabled”指示灯进行监控：



If the IMD is waiting for a safety-chain reset, (for example after the input in one of the SCI inputs was cycled) the following actions must be performed in this order to get the IMD back to normal operation:

如果 IMD 正在等待安全链复位（例如，在一个 SCI 输入中的输入被循环后），则必须按照此顺序执行以下操作，以使 IMD 恢复正常操作：

1. Any errors must be cleared (error removed and cleared) 必须清除任何错误（删除并清除错误）
2. Cycle safety-chain inputs 循环安全链输入
6. Reset “Enable off” bit 重置 “Enable off” 位

Timing: After the RUN input has gone high, a 5 ms delay must pass before command values can be sent to the drive. 定时：RUN 输入变高后，必须经过 5 毫秒的延迟，才能将命令值发送到驱动器。

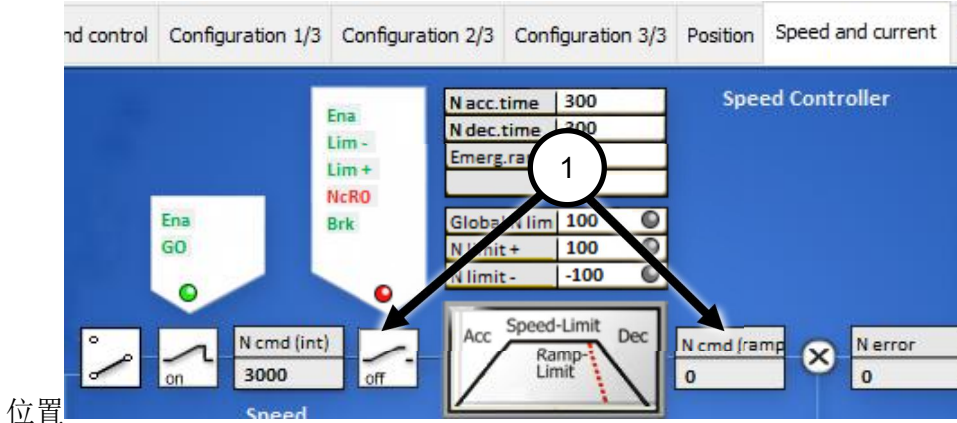
The “Enable off” bit can also be reset automatically at start-up if no limit switch is activated. See auto safety-run at start-up in section 8.4.3 on page 125. 如果没有激活限位开关，“Enable off” 位也可以在启动时自动复位。参见第 95 页第 8.4.3 节启动时的自动安全运行。

9.5 Forcing speed zero 强制速度为零

It is possible to force the speed controller (it will have the same effect on torque) by using a logical input or a CAN command that sets the NcR0 bit. When the NcR0 bit is set, the switch to the speed ramp is set to Off, and the N cmd (ramp) is set to zero. This function has no effect on the N cmd (int) and it is still possible to change the value of N cmd (int). As long as this function is enabled (NcR0) the motor is held in position by the IMD.

可以通过使用逻辑输入或设置 NcR0 位的 CAN 命令来强制速度控制器（它会对扭矩产生相同的影响）。设置 NcR0 位时，速度坡道开关设置为 Off，N cmd（坡道）设置为零。此功能对 N cmd（int）

没有影响，仍然可以更改 N cmd (int) 的值。只要启用此功能 (NcR0)，IMD 就会将电机保持在合适



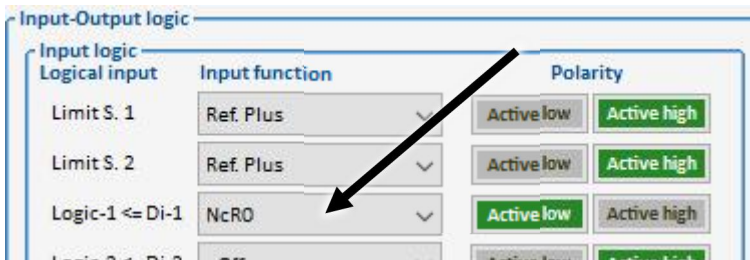
9.5.1 Prerequisites 先决条件

The IMD must be in state 1 (Normal operation). IMD 必须处于状态 1 (正常操作)。

9.5.2 Activation 激活

HW input: 硬件输入:

1. Connect the wire to either Di-1 or Di-2 terminals. 将电线连接至 Di-1 或 Di-2 端子。
2. In the IMD Manager “Configuration 1/3”, set the logical input for the connected terminal to NcR0: 在 IMD 监控软件“配置 1/3”中，将连接终端的逻辑输入设置为 NcR0:



7. Select the polarity (active low or active high) depending on the source. 根据电源选择极性 (低电平或高电平)。

IMD Manager: Do the same as for HW input. Set the NcR0 on by changing the polarity.

IMD 监控软件: 与硬件输入相同。通过改变极性来设置 NcR0。

CAN/CANopen: Set bit 1 in the Device mode register (Reg. 0x51, bit 1 = 1) 在设备模式寄存器中设置 1 位 (Reg. 0x51, 1 位 = 1)

9.5.3 Operation 操作

See description in the beginning of section 9.5 on page 179. 见第 136 页第 9.5 节开头的说明。

9.5.4 Deactivation 停用

HW input: the NcR0 will be deactivated when the polarity is changed to the not active polarity.

HW 输入: 当极性更改为非激活极性时，NcR0 将停用。

IMD Manager: Change the polarity, or set the Input function of the logic input to –Off–.

IMD 监控软件：更改极性，或将逻辑输入的输入功能设置为 – Off – 。

CAN/CANopen: Reset bit 1 in the Device mode register (Reg. 0x51, bit 1 = 0)重置设备模式寄存器 (Reg.0x51, 位 1=0)



Info

Logical input must be in inactive or Off, AND bit 1 in register 0x51 must be zero in order to disable NcR0.

信息

逻辑输入必须处于非激活状态或关闭状态，并且寄存器 0x51 中的第 1 位必须为零，以禁用 NcR0。

9.6 Manual operation 手动操作

It is possible to control the motor manually using digital inputs 10, 11, and 12 for service purposes. These inputs are intended to be connected to three switches in the pitch cabinet, and can be used with practically no regards to the logical state of the IMD.

Manual operation is enabled or disabled by a special command and a configuration parameter:

出于维修目的，可以使用数字输入 10、11 和 12 手动控制电机。这些输入旨在连接到变桨柜中的三个开关，并且实际上可以在不考虑 IMD 的逻辑状态的情况下使用。

通过特殊命令和配置参数启用或禁用手动操作：

- Register 0x01 bit 30: enables (1)/disables (0) manual operation

寄存器 0x01 位 30：启用（1）/禁用（0）手动操作

- Special commands (register 0x03) 26 and 27.

特殊命令（寄存器 0x03）26 和 27。

If special command no. 26 is sent, manual operation is disabled (even if register 0x01, bit 30 =1):

如果发送了 26 号特殊命令，则禁用手动操作（即使寄存器 0x01，位 30=1）：

- If not in manual operation state, it is not possible to go into manual operation.如果未处于手动操作状态，则无法进入手动操作。
- If in manual operation state, it is not possible to move the motor.如果处于手动操作状态，则无法移动电机。

Sending a special command (register 0x03) no. 27 cancels command 26. However, it will not be possible to use manual operation if register 0x01, bit 30 =0). It is not necessary to send this command if command 26 was not used.

发送第 27 号特殊命令（寄存器 0x03）将取消命令 26。但是，如果寄存器 0x01 位 30=0，则无法使用手动操作。如果未使用命令 26，则无需发送此命令。

If VLMS are used, it is not possible to pitch past them in this mode. See section [9.7](#) on page [185](#) for pitching past the VLMS.

During manual operation the position is stored by the IMD every time the motor and brake output are deactivated.

If a “Bus timeout” error is active when the manual operation is activated, the error is reset.

There are two main manual operation modes depending on the configuration of Reg. 0x01 bit 23 (SCI state):

如果使用 VLM，则在此模式下无法变桨通过 VLM。有关通过 VLM 的变桨，请参见第 140 页第 9.7 节。在手动操作期间，每次停用电机和制动器输出时，IMD 都会存储该位置。

如果激活手动操作时出现“总线超时”错误，则会重置该错误。

根据 Reg0x01 第 23 位（SCI 状态）的配置，有两种主要的手动操作模式。：

- Reg. 0x01 bit 23 (SCI state) set to OK: manual operation depends entirely on the digital inputs 10, 11, and 12. When going out of the mode, the IMD always goes to normal operation state (1).

Reg. 0x01 第 23 位（SCI 状态）设置为正常：手动操作完全取决于数字输入 10、11 和 12。当退出模式时，IMD 始终进入正常操作状态（1）。

- Reg. 0x01 bit 23 (SCI state) set to Not OK: manual operation dependent on both digital inputs 10, 11, and 12 and special commands. When going out of the mode, the IMD always performs a safety run.

Reg.0x01 第 23 位（SCI 状态）设置为不正常：手动操作取决于数字输入 10、11 和 12 以及特殊命令。当退出模式时，IMD 始终执行安全运行。

9.6.1 Reg. 0x01 bit 23 (SCI state) set to OK

Reg. 0x01 第 23 位（SCI 状态）设置为正常

9.6.1.1 Prerequisites 先决条件

- Manual operation must be enabled in the configuration (0x01, bit 30 =1). 必须在配置中启用手动操作（0x01，位 30=1）。



- SCI state for manual operation must be set to OK (0x01, bit 23 =0). 手动操作的 SCI 状态必须设置为 OK（0x01，位 23=0）。



- Three switches must be connected to Digital inputs 10, 11 and 12 and 24 V DC (see section 5.5.1 on page 58). 三个开关必须连接到数字输入 10、11 和 12 以及 24V DC（见第 47 页第 5.5.1 节）。
- The IMD must be in one of the states that allow entry to manual operation (have manual operation as condition to proceed, see Table 6 on page 70). The safety chain must be in OK state. IMD 必须处于允许进入手动操作的状态之一（以手动操作作为继续操作的条件，见第 57 页表 6）。安全链必须处于正常状态。

9.6.1.2 Activation 激活

The IMD is brought into manual operation mode by activating DI 12 (high) following by either DI 11 or DI 10 (rising edge). 通过在 DI 11 或 DI 10（上升沿）之后激活 DI 12（高），IMD 进入手动操作模式。

9.6.1.3 Operation 操作

While in manual operation mode only activating DI 10 or DI 11 will move the motor (D10: “-“ direction, D11: “+” direction). The configuration parameters for manual operation will be used.

If either RUN or RFE inputs are low, or the SCI, input changes state, the output to the motor will be disabled.

If Virtual limit switches (VLMS) are used, the motor stops (normal stop) when the number of revolutions defined in the VLMS is reached. It is then only possible to move the motor the other way (In the direction of where it came from).

No automatic actions (such as safety run) will be performed while in manual operation mode.

在手动操作模式下，只有激活 DI 10 或 DI 11 才会移动电机（D10：“-”方向，D11：“+”方向）。将使用手动操作的配置参数。

如果 RUN 或 RFE 输入为低，或者 SCI 输入更改状态，则电机的输出将被禁用。

如果使用虚拟限位开关 (VLMS)，当达到 VLMS 中定义的转数时，电机将停止（正常停止）。只能以另一种方式移动电机（沿其来源方向）。

9.6.1.4 Deactivation 停用

Deactivate DI 12 (low), the IMD performs a safety run. 停用 DI 12（低），IMD 执行安全运行。

9.6.2 Reg. 0x01 bit 23 (SCI state) set to Not OK (safety chain tripped)

Reg.0x01 第 23 位（SCI 状态）设置为不正常（安全链跳闸）

If CAN/CANopen connection is not active (not connected or communication error) the manual operation will behave as described in section 9.6.1 on page 182 (activation, operation and deactivation), except for the following: 如果 CAN/CANopen 连接未激活（未连接或通信错误），则手动操作将按照第 138 页第 9.6.1 节（激活、操作和停用）的规定进行，但以下情况除外：

- SCI state must be Not OK SCI 状态必须不正常
- On exit from manual mode the IMD performs a safety run 从手动模式退出时，IMD 执行安全运行
- Activating DI 12 if the SCI state is OK stops any motor movement 如果 SCI 状态正常，激活 DI 12 可停止任何电机运动
- Operation mode 360 is automatically enabled (0x01 bit 22=1) if DI 9 is activated 如果激活 DI 9，则自动启用操作模式 360（0x01 位 22=1）
- DI10 and DI 11 are always enabled DI10 和 DI11 始终处于启用状态

9.6.2.1 Prerequisites 先决条件

- Manual operation must be enabled in the configuration (0x01, bit 30 =1). 必须在配置中启用手动操作（0x01，位 30=1）。



- SCI state for manual operation must be set to Not OK (0x01, bit 23 =1). 手动操作的 SCI 状态必须设置为不正常（0x01，位 23=1）。



- Three switches must be connected to Digital inputs 10, 11 and 12 and 24 V DC (see section 5.5.1 on page 58). 三个开关必须连接到数字输入 10、11 和 12 以及 24V DC（见第 47 页第 5.5.1 节）。
- The IMD must be in one of the states that allow entry to manual operation (have manual operation as condition to proceed, see Table 6 on page 70). The safety chain must be in OK state.

IMD 必须处于允许进入手动操作的状态之一（以手动操作作为继续操作的条件，见第 57 页表 6）。安全链必须处于正常状态。

9.6.2.2 Activation 激活

The IMD is brought into manual operation mode by activating DI 12 (high). Any motor movement is stopped. 通过激活 DI 12 (高) 使 IMD 进入手动操作模式。任何电机运动都停止。

9.6.2.3 Operation 操作

While in manual operation mode only activating DI 10 or DI 11 will move the motor (D10: “-“ direction, D11: “+” direction). It is possible to disable/enable the function of DI 10 and DI 11 by sending (CAN/CANopen) a value to the special commands register (0x03):

在手动操作模式下，只有激活 DI 10 或 DI 11 才会移动电机（D10：“-”方向，D11：“+”方向）。通过向特殊命令寄存器 (0x03) 发送 (CAN/CANopen) 值，可以禁用/启用 DI 10 和 DI 11 的功能：

Value (dec.) 值	Description 描述
26	DI 10 and DI 11 are disabled, activating them does not move the motor DI 10 和 DI 11 被禁用，激活它们不会移动电机
27	DI 10 and DI 11 are enabled, activating them moves the motor as described above DI 10 和 DI 11 启用，激活它们可如上所述移动电机

The configuration parameters for manual operation will be used.

If either RUN or RFE inputs are low, or the SCI, input changes state, the output to the motor will be disabled.

If Virtual limit switches (VLMS) are used, the motor stops (normal stop) when the number of revolutions defined in the VLMS is reached. It is than only possible to move the motor the other way (In the direction of where it came from).

No automatic actions (such as safety run) will be performed while in manual operation mode.

将使用手动操作的配置参数。

如果 RUN 或 RFE 输入为低，或者 SCI 输入更改状态，则电机的输出将被禁用。

如果使用虚拟限位开关 (VLMS)，当达到 VLMS 中定义的转数时，电机将停止（正常停止）。只能以另一种方式移动电机（沿其来源方向）。

在手动操作模式下，不会执行任何自动操作（如安全运行）。

9.6.2.4 Deactivation 停用

Deactivate DI 12 (low).

If the SCI state is configured to OK, the IMD always goes to normal operation state.

If the SCI state is configured to Not OK, the IMD performs a safety run.

如果 SCI 状态配置为正常，则 IMD 始终进入正常操作状态。

如果 SCI 状态配置为不正常，IMD 将执行安全运行。

9.7 Manual operation 360 手动操作 360

Manual operation 360 is the same as manual operation except that VLMSs are ignored, and the motor keeps moving past the VLMS.

手动操作 360 与手动操作相同，只是忽略了 VLMS，并且电机不断移动经过 VLMS。

9.7.1 Prerequisites 先决条件

- The IMD is in manual operation mode IMD 处于手动操作模式
- Reg. 0x01 bit 22 (Manual operation 360) must be enabled (1). This can be done either by configuration using the IMD Manager, or by sending (CAN/CANopen) a value to the special commands register (0x03):

Reg. 0x01 位 22（手动操作 360）必须启用（1）。这可以通过使用 IMD 监控软件进行配置或通过向特殊命令寄存器（0x03）发送（CAN/CANopen）值来完成：

Value (dec.) 值	Description 描述
23	Manual operation 360 is enabled (0x01 bit 22=1) 手动操作 360 启用(0x01 位 22=1)
24	Manual operation 360 is disabled (0x01 bit 22=0) 手动操作 360 被禁用(0x01 位 22=0)

9.7.2 Activation 激活

The IMD is brought into manual operation 360 mode by activating DI 9 (high).通过激活 DI 9（高）使 IMD 进入手动操作 360 模式。

9.7.3 Operation 操作

The VLMS are ignored. VLMS 被忽略。

9.7.4 Deactivation 停用

Deactivate (low) DI 9 to go back to "Manual mode".

Deactivate (low) DI 12. To go back to normal operation state or perform a safety run (depending on the SCI state configuration). If DI 12 is deactivated the state of DI 9 does not matter.

停用（低）DI 9 以返回“手动模式”。

停用（低）DI 12. 返回正常操作状态或执行安全运行（取决于 SCI 状态配置）。如果 DI 12 停用，则 DI 9 的状态无关紧要。

9.8 Manually activating the fan 手动启动风扇

It is possible to activate the fan manually by using function 17 in the special commands. 可以使用特殊命令中的功能 17 手动启动风扇。



Info

This function is not supported on IMD 122 A and IMD 122 B.

信息

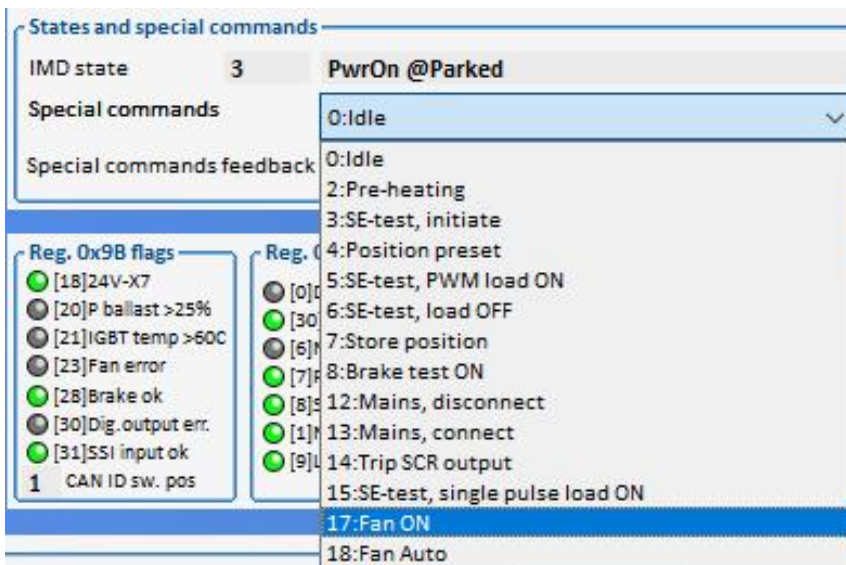
IMD 122 A 和 IMD 122 B 不支持此功能。

9.8.1 Prerequisites 先决条件

None. 无

9.8.2 Activation 激活

IMD Manager: Select “17:Fan ON” in the “States and special commands” in the “Monitor and control” tab. **IMD 监控软件:** 在“监控”选项卡的“状态和特殊命令”中选择“17：风扇开启”。



CAN/CANopen: send “17” to the special commands register (reg. 0x03)

The IMD will turn on the fan.

CAN/CANopen: 发送“17”到特殊命令寄存器（reg. 0x03）

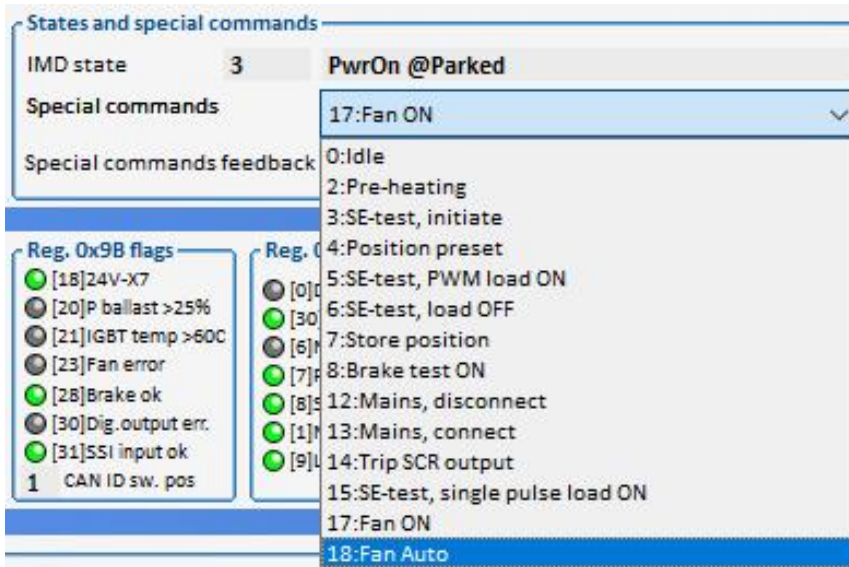
IMD 将打开风扇。

9.8.3 Operation 操作

The fan remains ON until special command 18 is sent to the IMD. 风扇保持开启，直到向 IMD 发送特殊命令 18。

9.8.4 Deactivation 停用

IMD Manager: Select “18:Fan Auto” in the “States and special commands” in the “Monitor and control” tab. **IMD 监控软件:** 在“监控”选项卡的“状态和特殊命令”中选择“18：风扇自动”。



CAN/CANopen: send “18” to the special commands register (reg. 0x03).

The fan will be back to in automatic control.

CAN/CANopen: 发送 “18” 到特殊命令寄存器 (reg. 0x03)。

风扇将回到自动控制状态。

9.9 Manually initiating a Safety run 手动启动安全运行

A safety run can be initiated manually either through CAN/CANopen command, or from the IMD Manager. 可以通过 CAN/CANopen 命令或从 IMD 监控软件手动启动安全运行。

9.9.1 Prerequisites 先决条件

If in Normal operation state, the drive must be enabled. 如果处于正常操作状态，则必须启用驱动器。



Note: Manual safety run can also be initiated while in states 3 (PwrOn @Parked), 4 (PwrOn not parked), or 5 (PwrOn not parked cold) where it only requires that the RUN input is high.

注意：手动安全运行也可以在状态 3（停机时上电）、4（未停机时上电）或 5（未冷却停机上电）时启动，其中仅需要 RUN 输入为高。

9.9.2 Activation 激活

IMD Manager: Click on the “S-run” button in the quick access area.

IMD 监控软件: 点击快速访问区域中的 “S-run” 按钮。



CAN/CANopen: send “1” to the “start safety run” register (Reg. 0x78)

The IMD will change to state 19 (Safety run setup) and start a safety run.

CAN/CANopen: 发送“1”到“启动安全运行”寄存器（Reg. 0x78）

IMD 将更改为状态 19（安全运行设置）并开始安全运行。

9.9.3 Operation 操作

N/A 不适用

9.9.4 Deactivation 停用

Once initiated, a safety run cannot be deactivated. It stops only by activation of a limit switch, or timeout.安全运行一旦启动，就不能被停用。它只有通过激活限位开关或超时才会停止。

9.10 Normal operation 正常操作

Normal operation is the state where the IMD controls the motor under normal conditions.

正常操作是 IMD 在正常条件下控制电机的状态。

9.10.1 Prerequisites 先决条件

The IMD must be in either Start up at park (3) or Parked ready (17) states.

RFE and RUN inputs (X9, terminals 1 and 2) must be high.

Safety chain inputs must be OK.

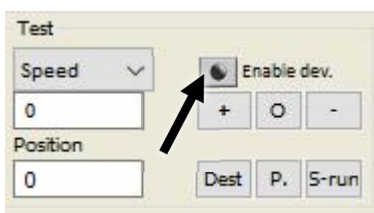
IMD 必须处于停机启动 (3) 或停机就绪 (17) 状态。

RFE 和 RUN 输入（X9，端子 1 和 2）必须为高。

安全链输入必须正常。

9.10.2 Activation 激活

IMD Manager: Click on the “Enable dev.” button:IMD 应用软件：点击“Enable dev”按钮：



CAN/CANopen: changes the “Enable dev.” (reg. 0x51 bit 2) to “0” (on).

CAN/CANopen: 将“Enable dev”更改为（reg. 0x51 位 2）位“0”（开启）。

9.10.3 Operation 操作

While in normal operation mode, is possible to disable and enable the drive by SW (reg. 0x51 bit 2), or HW (RUN input, X9-terminal 2). Both SW and HW must be enabled in order to enable the drive.

When the drive is disabled, the output to the motor goes to zero, and the brake output is deactivated (+24 off). The “Dev. Enabled” and “GO” flags are set to zero.

在正常操作模式下，可以通过 SW（reg. 0x51 位 2）或 HW（RUN 输入，X9 端子 2）禁用和启用驱动器。必须启用 SW 和 HW 才能启用驱动器。

当驱动器被禁用时，电机的输出变为零，制动器输出被禁用（+24 关闭）。“Dev. Enabled”和“GO”标志设置为零。

9.10.4 Deactivation 停用

Only errors and special commands will take the IMD out of the normal operation mode.

只有错误和特殊命令才会使 IMD 脱离正常操作模式。

9.11 Pre-heating the motor 预热电机

Activating the pre-heat function is done by using function 02 in the special functions.通过使用特殊功能中的功能 02 来激活预热功能。

9.11.1 Prerequisites 先决条件

The Device must be disabled (reg. 0x51 bit 2 = 1).设备必须被禁用（reg. 0x51 位 2 = 1）。

The IMD must be in one of the following states:IMD 必须处于以下状态之一：

- Normal operation (1) 正常操作（1）
- PwrOn@Parked 停机时上电
- PwrOn not Parked 未停机上电
- Parked ready 停机就绪

9.11.2 Activation 激活

IMD Manager: Select “2:Pre-heating” in the “States and special commands” in the “Monitor and control” tab. **IMD 监控软件：**在“监控”选项卡的“状态和特殊命令”中选择“2：预热”。



CAN/CANopen: send “2” to the special commands register (reg. 0x03)

The IMD changes state to 32 – “Pre-heating on” and changes the “Dev. Enable” LED indication in the IMD Manager to on.

CAN/CANopen: 发送“2”到特殊命令寄存器（reg. 0x03）

IMD 将状态更改为 32- “预热打开”，并将 IMD 监控软件中的 “Dev. Enable” LED 指示灯更改为打开。

9.11.3 Operation 操作

The IMD will remain in this state and pre-heat the motor until “0” (Idle) is sent to special commands register (reg. 0x03).

If the “Enable dev.” button is changed to off, the IMD goes to state 42 (Pre-heating warning), and stays in this state until the heating is deactivated. While in this state, the heating cannot be activated again.

IMD 将保持在这个状态并预热电机，直到 “0” (闲置)被发送到特殊命令寄存器(reg.0 x03)。

如果将 “Eev. Enable” 按钮设置为关闭，则 IMD 将进入 42 状态(预热警告)，并保持此状态直到关闭加热。在这种状态下，加热不能再被激活。

9.11.4 Deactivation 停用

IMD Manager: Select “0:Idle” in the “States and special commands” in the “Monitor and control” tab.

IMD 监控软件: 在 “监控” 选项卡的 “状态和特殊命令” 中选择 “0:Idle”。



CAN/CANopen: send “0” to the special commands register (reg. 0x03). The IMD goes back to “Normal operation” state and the “Dev. enable” is changed to off.

CAN/CANopen: 将 “0” 发送到特殊命令寄存器 (reg.0x03)。IMD 返回 “正常操作” 状态，“Dev. enable” 更改为关闭。

9.12 Restarting the IMD (by communication)重新启动 IMD (通过通信)

It is possible to restart the IMD by sending special commands combination. This feature only applies to IMD 122 C or later.

可以通过发送特殊命令组合来重新启动 IMD。此功能仅适用于 IMD 122 C 或更高版本。



Attention

This function should not be used unless absolutely necessary.

When used:

注意

除非绝对必要，否则不应使用此功能。

使用时：

- The output to the motor and the brake is stopped immediately (also if in safety run) and the motor is coasting out, only stopped by the motor’s brake. 电机和制动器的输出立即停止（如果在安全运行中）并且电机滑行，仅由电机制动器停止。
- All outputs are reset. 所有输出均复位。
- Protective actions such as “Mains, disconnect” are reset. 诸如“电源，断开”之类的保护动作被复位。

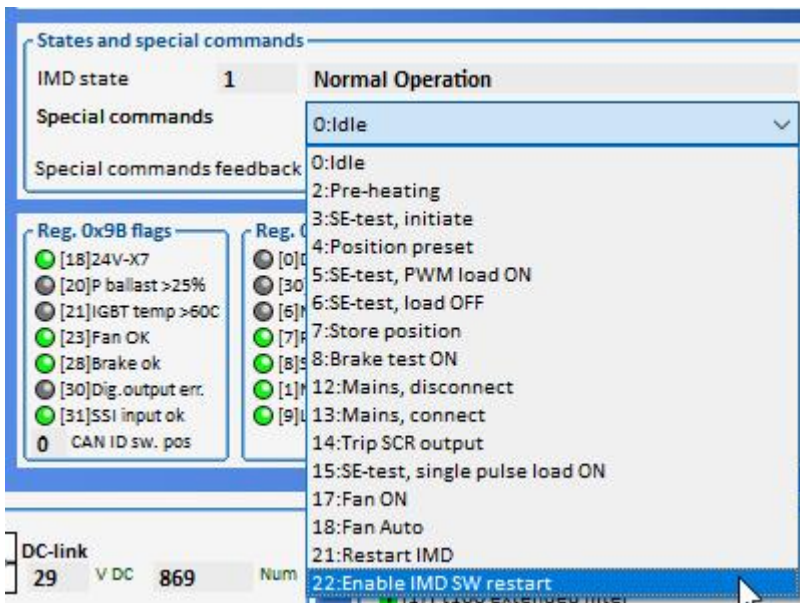
9.12.1 Prerequisites 先决条件

- None 无

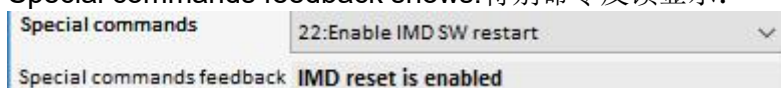
9.12.2 Activation 激活

IMD Manager: IMD 监控软件

1. Select “22:Enable IMD restart” in the “States and special commands” in the “Monitor and control” tab: 在“监控”选项卡的“状态和特殊命令”中选择“22：启用IMD重启”：

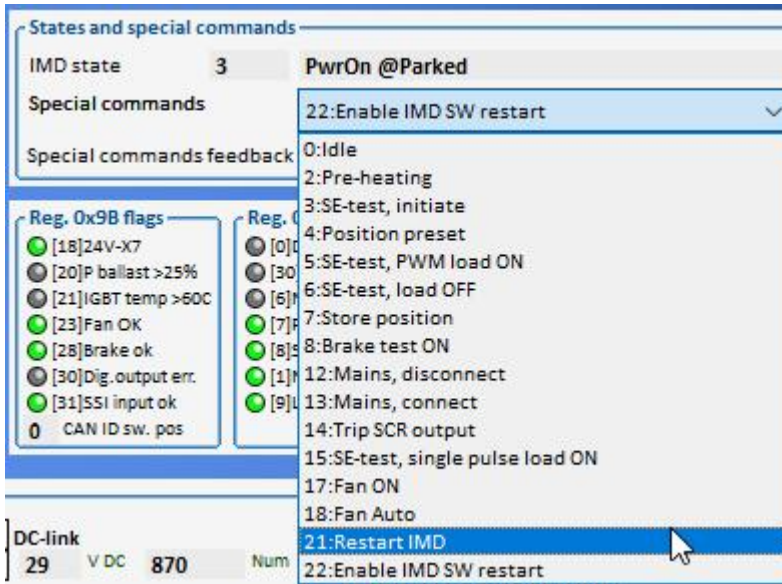


Special commands feedback shows: 特别命令反馈显示:



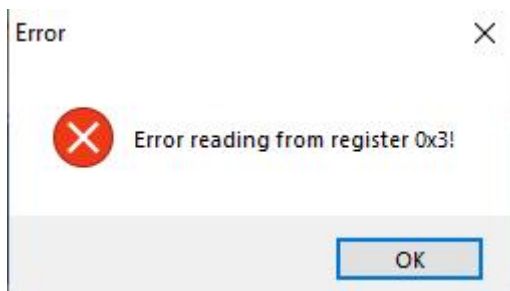
2. Select “21:Restart IMD” in the “States and special commands” in the “Monitor and control” tab:

在“监控”选项卡的“状态和特殊命令”中选择“21：重新启动 IMD”：

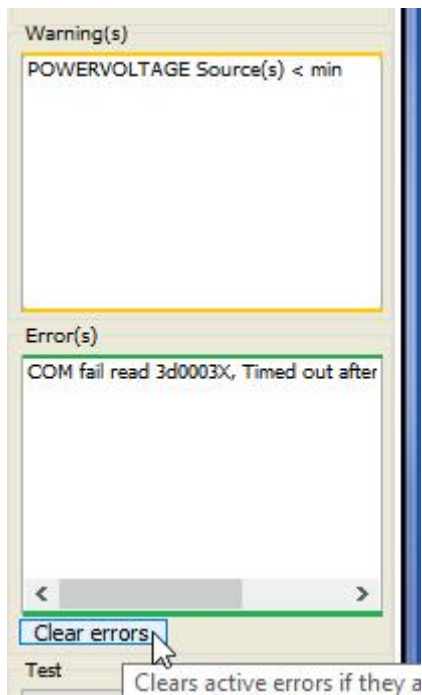


The IMD Manager will show an error dialog box. Click “OK”:

IMD 监控软件将显示一个错误对话框。单击“确定”：



3. The IMD Manager show a (green) communication error. Click on the “Clear errors” button to clear the communication error. IMD 监控软件显示（绿色）通信错误。单击“清除错误”按钮以清除通信错误。



CAN/CANopen:

1. Send "22" to the special commands register (reg. 0x03)将 "22" 发送到特殊命令寄存器 (reg. 0x03)
2. Send "21" to the special commands register (reg. 0x03)将 "21" 发送到特殊命令寄存器 (reg. 0x03)

9.12.3 Operation 操作

N/A 不适用

9.12.4 Deactivation 停用

N/A 不适用

9.13 Safe energy (ultra-capacitors only) discharging 后备电源 (仅限超级电容器) 放电

It is possible to discharge ultra-capacitors for service purposes. Discharging is done using the ballast resistor to discharge the capacitors. 可以将超级电容器放电用于服务目的。使用制动电阻对电容器进行放电。

9.13.1 Prerequisites 先决条件

The IMD must be in one of the following states:IMD 必须处于以下状态之一：

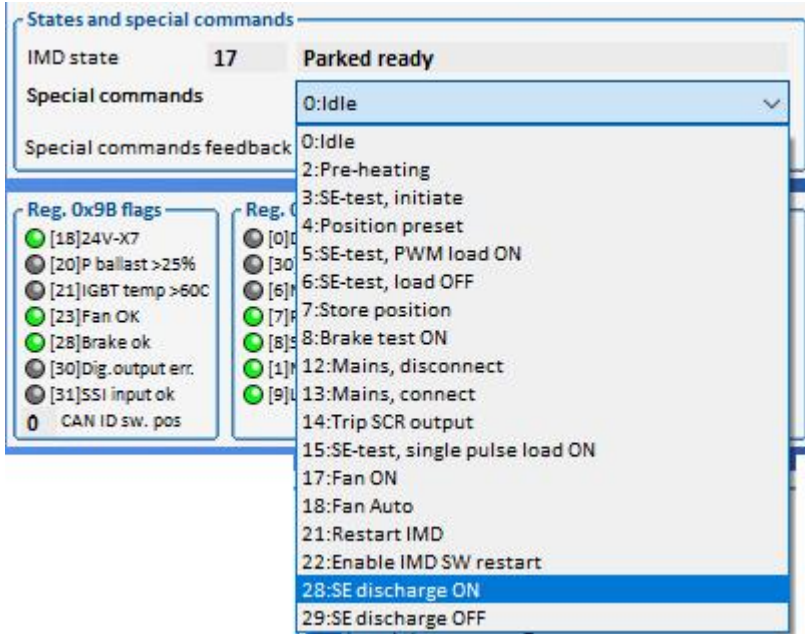
- SCR tripped (10)SCR 跳闸 (10)
- Parked tripped (16)停机跳闸 (16)
- Parked ready (17)停机准备就绪 (17)

- Safety run timeout (18)安全运行超时 (18)
- Manual operation (59)手动操作 (59)

9.13.2 Activation 激活

IMD Manager: Select “28:SE discharge ON” in the “States and special commands” group in the “Monitor and control” tab:

IMD 监控软件：在“监控”选项卡的“状态和特殊命令”组中选择“28:SE 放电开启”：



CAN/CANopen: send “28” to the special commands register (reg. 0x03).发送“28”到特殊命令寄存器(reg.0 x03)。

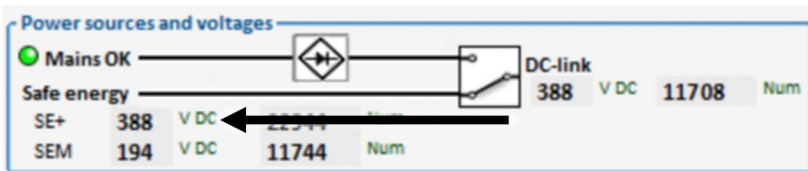
9.13.3 Operation 操作

When starting the discharge, the IMD disconnect the mains from the DC-link (“Mains, disconnect”), and turn the fan on. The discharge operation does not change the IMD state.

The Actual SE voltage can be monitored continuously in the IMD manger:

开始放电时，IMD 断开电源与直流母线的连接（“电源，断开”），然后打开风扇。放电操作不会改变 IMD 状态。

可以在 IMD 监控软件中持续监控实际 SE 电压：



Discharging fully loaded capacitors can take some time. To calculate the approximate time full discharge will take use the following formula:

对满载电容器放电可能需要一些时间。要计算完全放电的大致时间，将使用以下公式：

Formula:公式

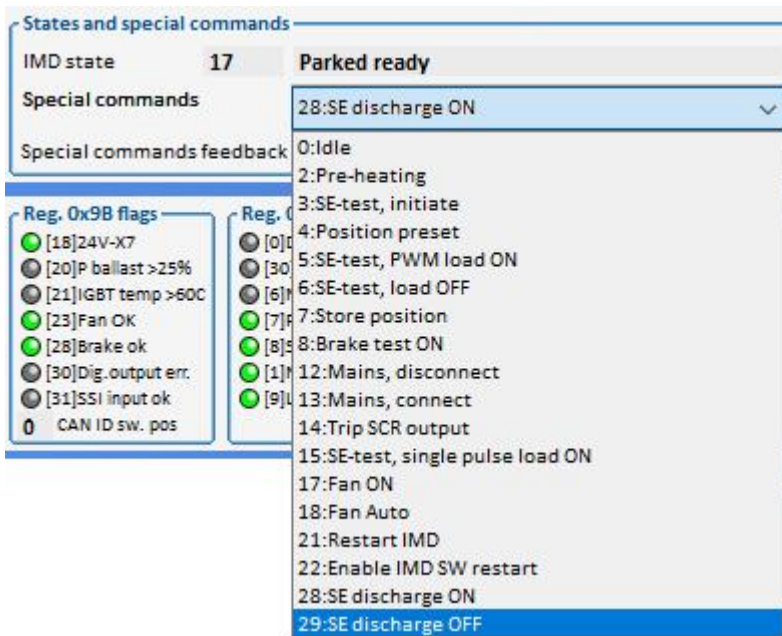
t: Total approximate discharge time (to zero) in s
以 s 为单位的总近似放电时间（到零）
C: Total SE capacity in F F 中的总 SE 容量

$t = \frac{0.5 * C * U^2}{P_b * 0.75}$	U: DC-link/SE voltage in V 以 V 为单位的直流母线/SE 电压 P _b : Ballast resistor rated power in W 制动电阻额定功率，单位为 W
Example: 示例 $t = \frac{0.5 * 2 * 450^2}{300 * 0.75} = 900s$	C: 2 F U: 450 V P _b : 300 W

9.13.4 Deactivation 停用

IMD Manager: Select “29:SE discharge OFF” or “0: Idle” in the “States and special commands” group in the “Monitor and control” tab:

IMD 监控软件：在“监控”选项卡的“状态和特殊命令”组中选择“29:SE 放电关闭”或“0:Idle”：



CAN/CANopen: send “29” to the special commands register (reg. 0x03).将“29”发送到特殊命令寄存器（reg.0x03）

The remaining voltage on the capacitors depends on the way the discharge stopped: 电容器上的剩余电压取决于放电停止的方式：

- If the discharge is stopped due to missing 24 VDC, the remaining voltage across the ultra-capacitors is approximately 100 V DC.如果由于缺少 24 VDC 而停止放电，超级电容器上的剩余电压约为 100 V DC。

NOTE Mains voltage applied on the Mains input, ensures that the internal 24 V DC power supply is functioning, even though the grid is off.

注意 主电源输入上施加的主电源电压可确保内部 24 V DC 电源在电网关闭的情况下运行。

- If the discharged is stopped by a command (“29:SE discharge OFF” or “0: Idle”), the remaining voltage across the ultra-capacitors depends on the capacity and charge level of the ultra-capacitors, discharge time, and the ballast resistor.

NOTE After deactivation the grid remains disconnected.

如果通过命令（“29:SE 放电关闭”或“0:Idle”）停止放电，超级电容器上的剩余电压取决于超级电容器的容量和充电水平、放电时间和制动电阻。

注：停用后，电网保持断开状态。

9.14 Tripping safety-chain outputs 跳闸安全链输出

It is possible to trip the safety-chain outputs (SCR1 and SCR 2) manually, which can be used for example to trip the safety chain relay.可以手动使安全链输出（SCR1 和 SCR 2）跳闸，例如可用于使安全链继电器跳闸。

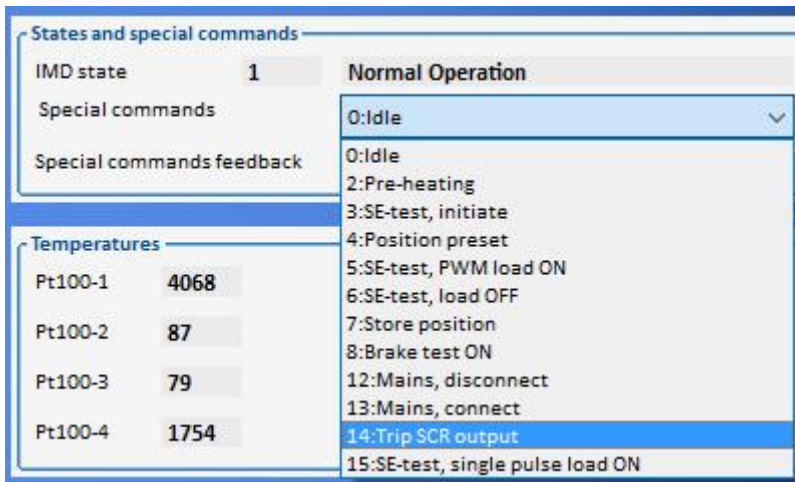
9.14.1 Prerequisites 先决条件

There must be no active errors.必须没有激活的错误。

9.14.2 Activation 激活

IMD Manager: Select “14:Trip SCR output” in the “States and special commands” in the “Monitor and control” tab.

IMD 监控软件：在“监控”选项卡的“状态和特殊命令”中选择“14：跳闸 SCR 输出”。



CAN/CANopen: send “14” to the special commands register (reg. 0x03)

The IMD will trip SCR 1 and SCR 2, and depending on the state it is in, change the state.

CAN/CANopen: 将“14”发送到特殊命令寄存器（reg.0x03）

IMD 将使 SCR 1 和 SCR 2 跳闸，并根据其所处的状态改变状态。

9.14.3 Operation 操作

N/A 不适用

9.14.4 Deactivation 停用

N/A 不适用

9.15 Turning the power to the IMD on 接通 IMD 电源

Ensure that all connections to the IMD are made. 确保所有与 IMD 的连接都已建立。



Attention

If the safe energy was disconnected from the SE terminals, the mains supply must be turned on before the safe energy is turned on.

注意

如果安全电源与 SE 端子断开，则必须先接通主电源，然后再接通安全电源。

1. Switch the supply to X1.MAINS on 将电源切换至接通 X1.1 电源
2. If there is a separate supply to X7.24V switch it on (can also be turned on at the same time as Mains supply) 如果有单独的 X7.24V 电源，则将其接通（也可以与主电源同时接通）
3. Switch the supply to X1.SAFE ENERGY on 将电源切换至接通 X1.1 安全电源

9.16 Updating Firmware 更新固件

There are two ways to update the firmware (FW) of the IMD: 有两种方法可以更新 IMD 的固件 (FW) :

1. **Update through the “Service” USB connector:** mainly used in production, service and lab.

通过“服务”USB 接口更新：主要用于生产、服务和实验室。

2. **Update through CANopen:** mainly used in cases when updating remotely, thus eliminating the need for physical presence in the hub.

通过 CANopen 更新：主要用于远程更新的情况，从而无需在集线器中实际存在。

When updating through the Service USB connector, an internal bootloader initiated by setting the CAN ID switch to 15 and restarting the IMD is used to load the new firmware.

When updating through CANopen, a special bootloader must be loaded first through the Service connector (one time only), and is initiated when needed by a CANopen command.

Using CANopen update method requires development and implementation (by the customer) of update SW in the Pitch Motion Controller or the turbine’s Main Controller.

It is also possible to load both CANopen bootloader and FW through the Service USB connector (the IMD is then prepared for FW update through CANopen in the future).

The full FW package contains different files which are used depending on the update method chosen (the bootloader will typically be released in a separated release package):

通过服务 USB 连接器更新时，通过将 CAN ID 开关设置为 15 并重新启动 IMD 启动的内部引导加载程序用于加载新固件。

通过 CANopen 更新时，必须首先通过服务连接器（仅一次）加载一个特殊的引导加载程序，并在需要时由 CANopen 命令启动。

使用 CANopen 更新方法需要（由客户）在变桨控制器或风机主控制器中开发和实施更新软件。

还可以通过服务 USB 连接器加载 CANopen 引导加载程序和固件（IMD 随后准备好在将来通过 CANopen 进行固件更新）。

完整的固件包包含不同的文件，根据选择的更新方法使用不同的文件（引导加载程序通常会在单独的发布包中发布）：

Table 23 FW packages and installation methods

表 23 固件包及安装方法

Installation method 安装方法	Files 文件夹	Description 描述
“Service” USB connector “服务” USB 连接器	<ul style="list-style-type: none"> IMD.out 	<p>Only FW application is installed. Internal built-in bootloader is used for the installation. Programming mode (built-in bootloader) is initiated by setting CAN ID to 15 and restarting the IMD.</p> <p>仅安装了 FW 应用程序。内部内置引导加载程序用于安装。通过设置 CAN ID 为 15 并重新启动 IMD 来启动编程模式(内置引导加载程序)。</p> <p>NOTE If the <code>IMD.out</code> file is installed after the CANopen bootloader is installed, the bootloader will be erased and overwritten.</p> <p>注意 如果在安装 CANopen 引导加载程序后安装 <code>IMD.out</code> 文件，引导加载程序将被擦除和覆盖。</p>
CANopen	<ul style="list-style-type: none"> IMD_Bootloader.out CoU_IMD.crc 	<p>In the first time, the bootloader (<code>IMD_Bootloader.out</code>) is installed through the “Service” USB connector, followed by FW application (<code>CoU_IMD.crc</code>) installation through CANopen. In later updates only the FW application is installed through CANopen, using the already installed bootloader.</p> <p>The bootloader is initiated by a CAN command.</p> <p>首次通过 “Service” USB 连接器安装引导加载程序 (<code>IMD_Bootloader.out</code>)，然后通过 CANopen 安装 FW 应用程序 (<code>CoU_IMD.crc</code>)。在以后的更新中，只有 FW 应用程序通过 CANopen 安装，使用已安装的引导加载程序。</p> <p>引导加载程序由 CAN 命令启动。</p>
CANopen files through USB “service” connector 可以通过 USB “服务” 连接器打开文件	<ul style="list-style-type: none"> IMD_Bootloader.out CoU_IMD.out 	<p>This is an installation of CANopen files installed through the “Service” USB connector. It can be used to prepare the IMD for later CANopen FW updates.</p> <p>Programming mode (built-in bootloader) is initiated by setting CAN ID to 15 and restarting the IMD.</p> <p>此安装通过 “服务” USB 连接器安装 CANopen 文件。它可用于为以后的 CANopen 固件更新准备 IMD。</p>

9.16.1 Updating firmware with the Service USB connector method 使用服务 USB 连接器方法更新固件

9.16.1.1 Prerequisites 先决条件

- A computer with Spectrum Digital SDFlash program installed (including V3.3 SDFlash serial patch for flash programming, September 5, 2008),
- 一台装有 Spectrum Digital SDFlash 程序的计算机(包括用于 flash 编程的 V3.3 SDFlash 串行补丁, 2008 年 9 月 5 日), (<http://emulators.spectrumdigital.com/utilities/sdflash/>)

Typically, the necessary USB driver will be found automatically if the computer is on-line. Otherwise, go to Silicon Labs home page and download the latest driver for CP210x USB to UART Bridge

通常, 如果计算机在线, 将自动找到必要的 USB 驱动程序。否则, 请转到 Silicon Labs 主页并将 CP210x USB 的最新驱动程序下载到 UART 网桥 (<http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>).



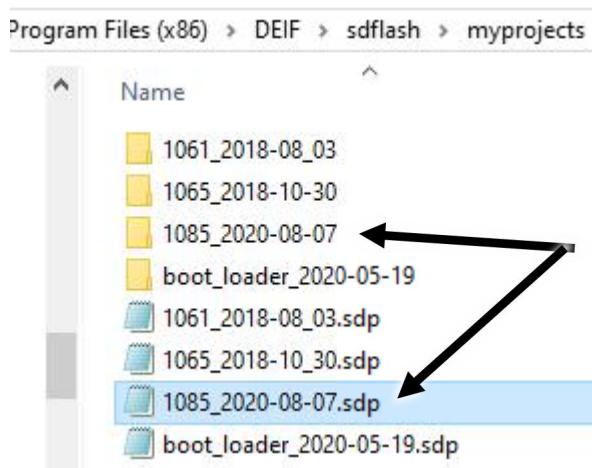
Info

The links above were valid at the time when this manual was written. If the link does not work anymore, search for “V3.3 SDFlash serial patch” or “CP210x USB to UART Bridge driver”.

信息

上述链接在编写本手册时有效。如果链接不可用, 请搜索 “V3.3 SDFlash serial patch” 或 “CP210x USB to UART Bridge driver”。

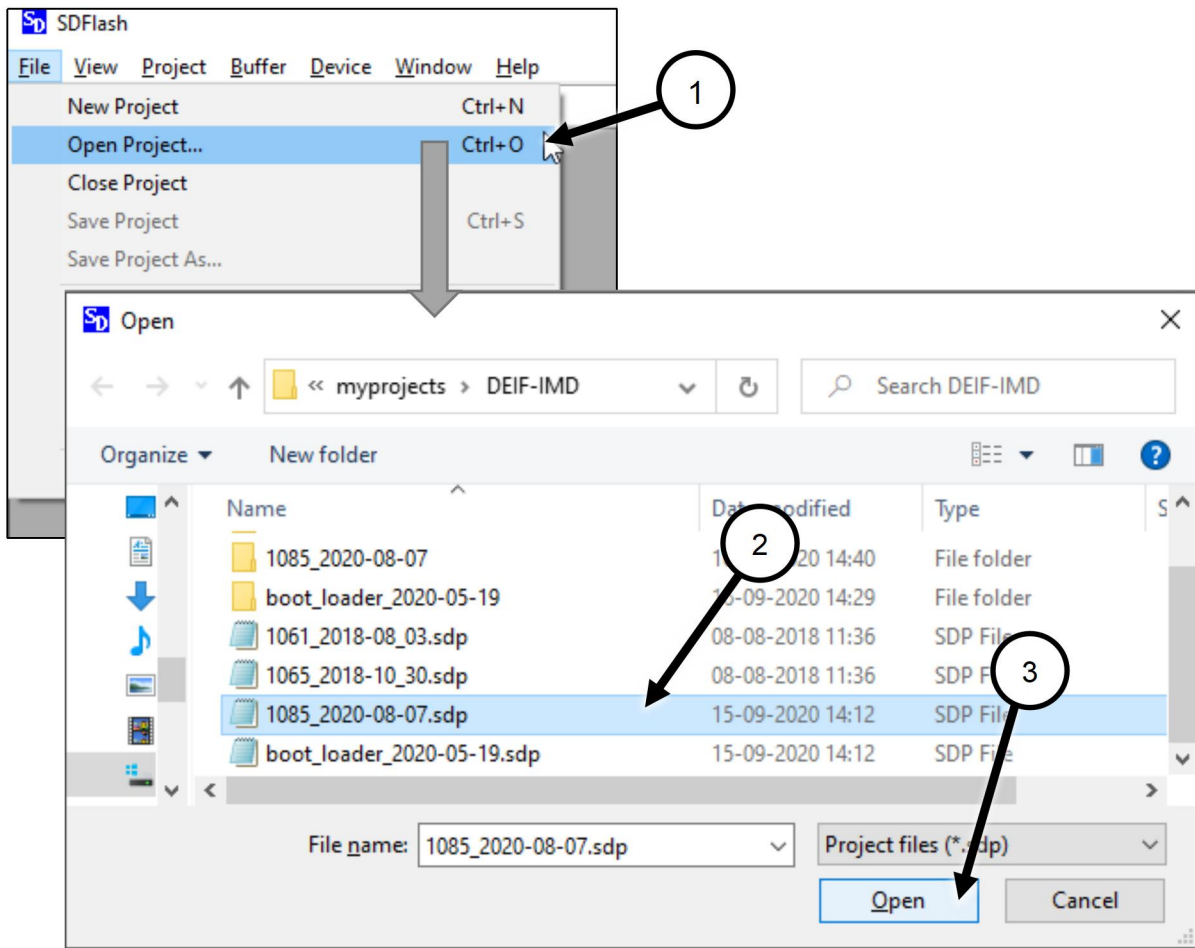
- The computer must be connected to the IMD with USB cable (male type A to male type B). 必须将计算机通过 USB 电缆 (A 型公头到 B 型公头) 连接到 IMD。
- Prepare the FW files for use: 准备要使用的固件文件:
 1. Copy the folder of the new FW. 复制新固件的文件夹。
 2. Paste the folder in the folder where other FW is located. 将文件夹粘贴到其他固件所在的文件夹中。
If the FW files are located at their default location, go to `myprojects` folder in `sdfash` folder (where `sdfash` was installed) and paste the folder under `myprojects`.
NOTE The files can be located anywhere. It is possible to brows to the location and `sdfash` remembers this location.
如果固件文件位于其默认位置, 请转到 `sdfash` 文件夹 (安装 `sdfash` 的位置) 中的 `myprojects` 文件夹并将该文件夹粘贴到 `myprojects` 下。
注 文件可以存放在任何位置。可以浏览到该位置, `sdfash` 会记住该位置。
 3. Copy any of the `.sdp` files in the folder and paste it (the `.sdp`). 复制文件夹中的所有 `.sdp` 文件并粘贴它 (即 `.sdp`)。
 4. Rename the `.sdp` file to the same name as the new FW folder: 将 `.sdp` 文件重命名为与新 FW 文件夹相同的名称:



9.16.1.2 Updating firmware – USB FW 更新固件 – USB FW

1. Before turning the power to the IMD ON (24 V DC if the IMD does not have built-in power supply, or 400 V AC if it does have a built-in power supply), ensure that the RFE input is OFF to prevent the IMD from starting the motor unintentionally. 接通 IMD 电源之前（如果 IMD 没有内置电源，则为 24 V DC；如果 IMD 有内置电源，则为 400 V AC），确保 RFE 输入已关闭，以防止 IMD 意外启动电机。
2. Start the SDFlash if it is not started already. 如果 SDFlash 尚未启动，则启动 SDFlash。
3. Set the IMD into programming mode by doing the following: 通过执行以下操作将 IMD 设置为编程模式：
 - a. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) off. 关闭 24 V DC（如果内置 DC 电源，则关闭 400 V AC）
 - b. Set the CAN ID switch to position 15. 将 CAN ID 开关设置到位置 15。
 - c. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) on. 打开 24 V DC（如果内置 DC 电源，则打开 400 V AC）。
4. Click File→Open Project... (1), select and select the .sdp file that belongs to the FW that should be installed (2) and click Open

点击 FileOpen Project... (1) 选择需要安装的 FW 中的.sdp 文件 (2) 点击 Open



(3):

5. Skip this step if the used Com port is known.

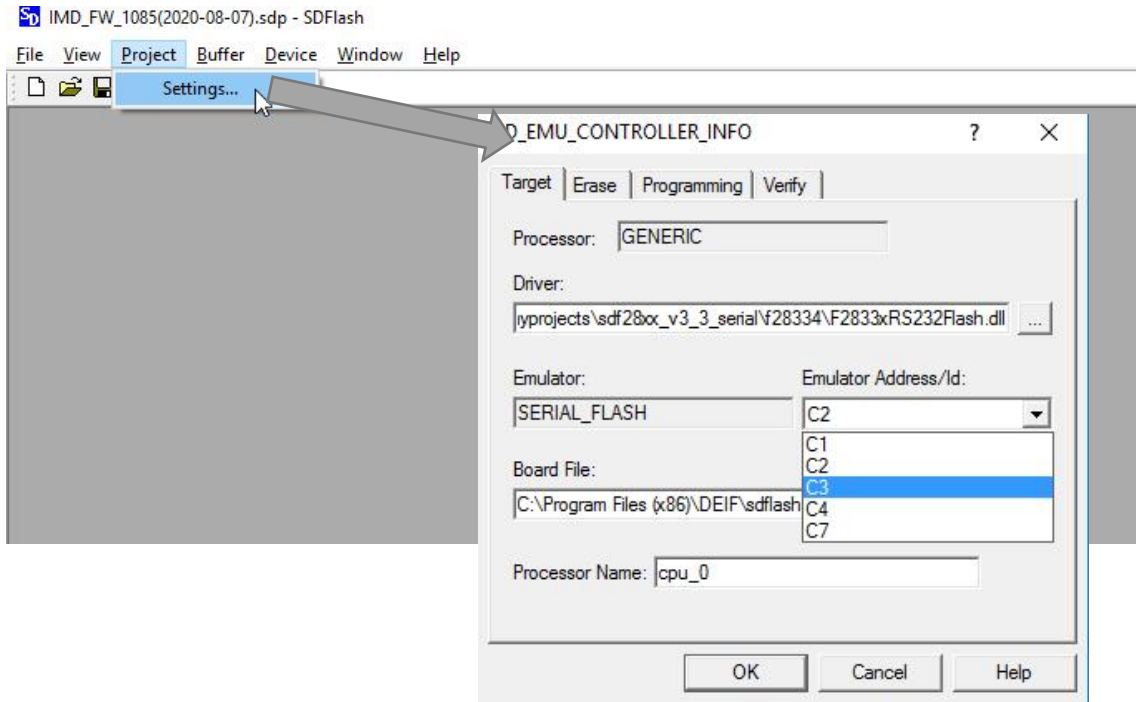
Open the “Device manager” in the computer’s “Settings” and determine which com port is used for the USB connection (the look and name of the device manager may differ depending on the operating system). Only Com1, Com2, Com3, and Com4 can be used with the SDFlash, if another port is selected by the system, you will need to change it so one of the mentioned ports is used:

如果已知使用的 Com 端口，则跳过此步骤。

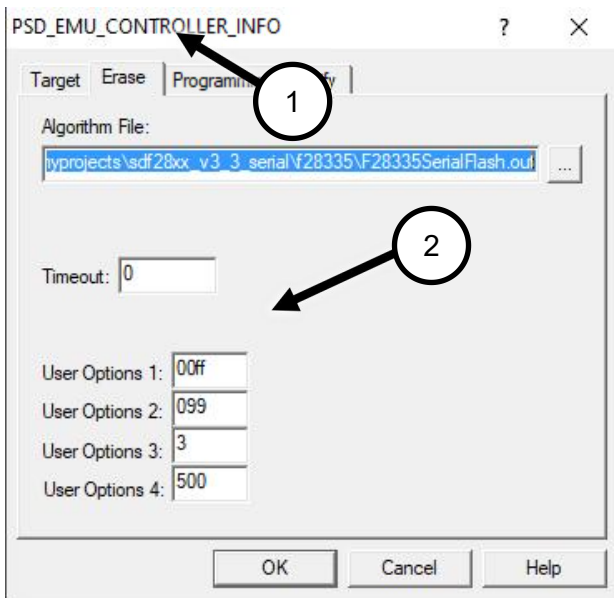
打开计算机“设置”中的“设备监控软件”，确定用于 USB 连接的 com 端口（设备监控软件的外观和名称可能因操作系统而异）。SDFlash 只能使用 Com1、Com2、Com3 和 Com4，如果系统选择了另一个端口，则需要对其进行更改，以便使用上述端口之一：



- Click on Project → Settings... to open the Settings dialogue. Select the same com port as used in the device manager (COM1 → C1): 点击 Project Settings... 打开 Settings 对话框。选择与设备监控软件 (COM1 C1) 相同的 com 口:

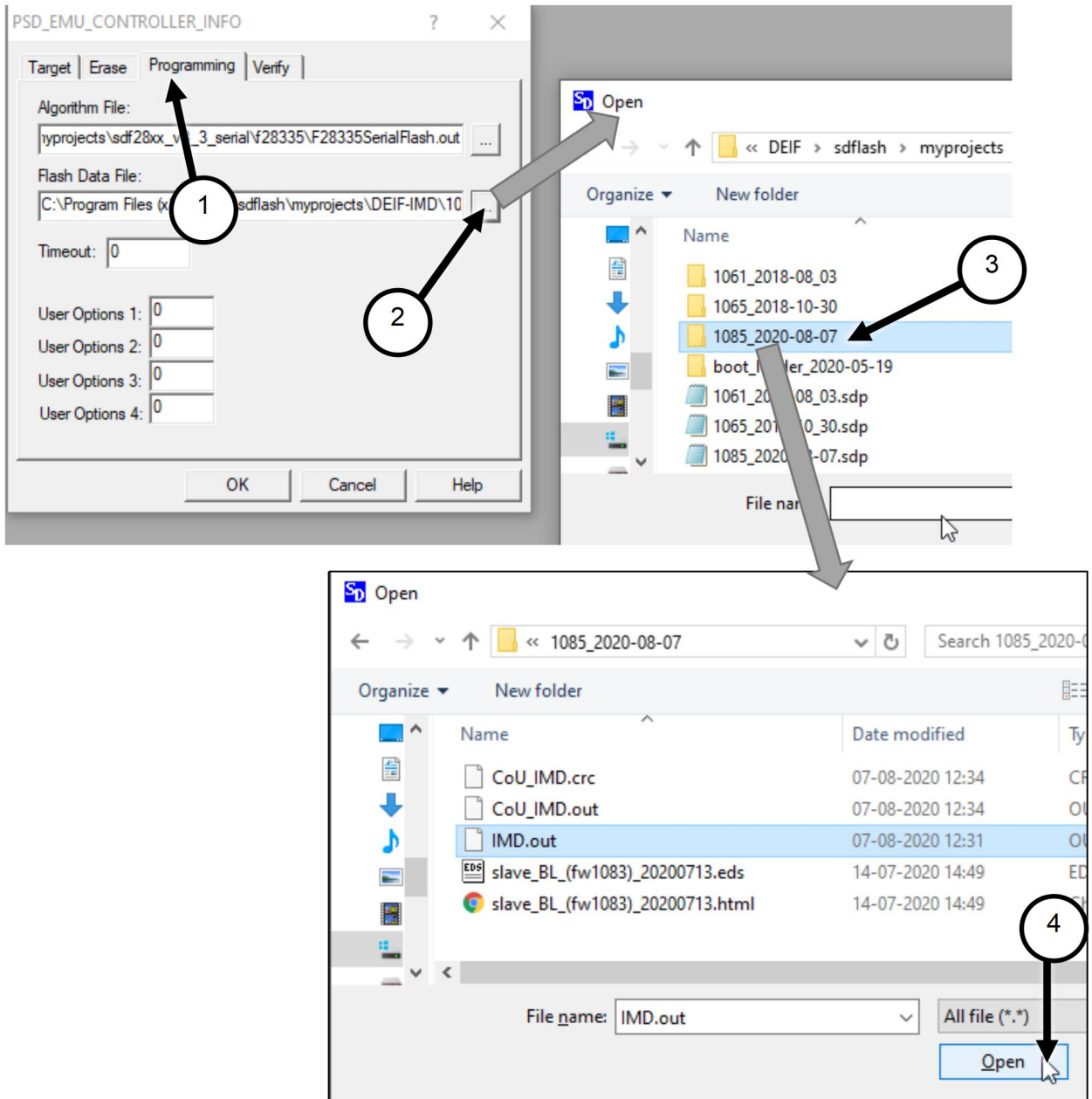


- Click on the “Erase” tab (1), and ensure that “User Options 1:” is set to “00ff” (2):
 点击 “Erase” 选项卡 (1), 确保 “User Options 1:” 设置为 “00ff” (2):



- Click on the “Programming” tab (1), then on the ... button of the Flash Data File (2), double click on the FW folder (3), select the IMD.out file and click Open (4):

点击 “Programming” 选项卡 (1), 然后在闪存数据文件 (2) 的...按钮上, 双击 FW 文件夹 (3), 选择 IMD.out 文件并单击打开 (4):



9. Click OK.单击“确定”。



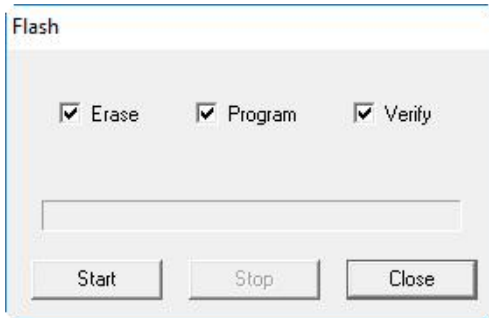
Info

If the com port or user option 1 was changed, you will be asked to save you project settings first, when attempting to upgrade the firmware in an IMD.

信息

如果 com 端口或用户选项 1 被更改，当尝试在 IMD 中升级固件时，您需要首先保存项目设置。

10. Click on Device → Flash... to open the upgrade dialogue: 点击 Device Flash... 打开升级对话框:



11. Ensure that all three checkboxes are ticked and click Start.. 确保勾选了所有三个复选框，然后单击开始。

12. When the programming cycle is completed, set the IMD back to normal operation mode: 编程完成后，将 IMD 设置为正常操作模式:

- a. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) off. 关闭 24 V DC (如果内置 DC 电源，则关闭 400 V AC)。
- b. Set the CAN ID switch back to its original position. 将 CAN ID 开关设置回其原始位置
- c. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) on. Note that the first startup after firmware upgrade might take longer (up to approximately 10 s). 打开 24 V DC (如果内置 DC 电源，则打开 400 V AC)。请注意，固件升级后的首次启动可能需要更长的时间 (最多约 10 秒)。

13. The IMD is now updated. IMD 现已更新



Info

On rare occasions, The SDFlash program will show a “Connection error” after step [11](#) on page [204](#) is executed. In such a case, it is necessary to restart the whole process:

信息

在极少数情况下，执行第 156 页的步骤 11 后，SDFlash 程序将显示“连接错误”。在这种情况下，有必要重新启动整个过程:

1. Close the SDflash program 关闭 SDflash 程序
2. Turn off the IMD 关闭 IMD
3. Start the SDflash 启动 SDflash
4. Turn on the IMD 启动 IMD
5. Repeat com configuration, and the actions described in steps [4](#) on page [200](#) to [13](#) on page [204](#). 重复 com 配置和第 153 页第 4 步至第 156 页第 13 步中描述的操作。

9.16.2 Updating firmware with CANopen files through USB “service” connector method 通过 USB“服务”连接器方法使用 CANopen 文件更新固件

Updating firmware with CANopen files, requires that a bootloader is installed as well. Once the bootloader is installed (see section [9.16.2.2](#) on page [206](#)), it is enough to install only the FW file (see section [9.16.2.3](#) on page [212](#) or section [9.16.3](#) on page [216](#) depending on the method).

使用 CANopen 文件更新固件时，还需要安装引导加载程序。一旦安装了引导加载程序（参见第 157 页第 9.16.2.2 节），仅安装 FW 文件就足够了（参见第 162 页第 9.16.2.3 节或第 166 页第 9.16.3 节，具体取决于方法）。

9.16.2.1 Prerequisites 先决条件

- A computer with Spectrum Digital SDFlash program installed (including V3.3 SDFlash serial patch for flash programming, September 5, 2008),
- 一台装有 Spectrum Digital SDFlash 程序的计算机(包括用于 flash 编程的 V3.3 SDFlash 串行补丁, 2008 年 9 月 5 日) (<http://emulators.spectrumdigital.com/utilities/sdfash/>)

Typically, the necessary USB driver will be found automatically if the computer is on-line. Otherwise, go to Silicon Labs home page and download the latest driver for CP210x USB to UART Bridge

通常, 如果计算机联机, 将自动找到必要的 USB 驱动程序。否则, 请转到 Silicon Labs 主页并将 CP210x USB 的最新驱动程序下载到 UART 网桥 (<http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>).



Info

The links above were valid at the time when this manual was written. If the link does not work anymore, search for “V3.3 SDFlash serial patch” or “CP210x USB to UART Bridge driver”.

信息

上述链接在编写本手册时有效。如果链接不再起作用, 请搜索 “V3.3 SDFlash serial patch” 或 “CP210x USB to UART Bridge driver”。

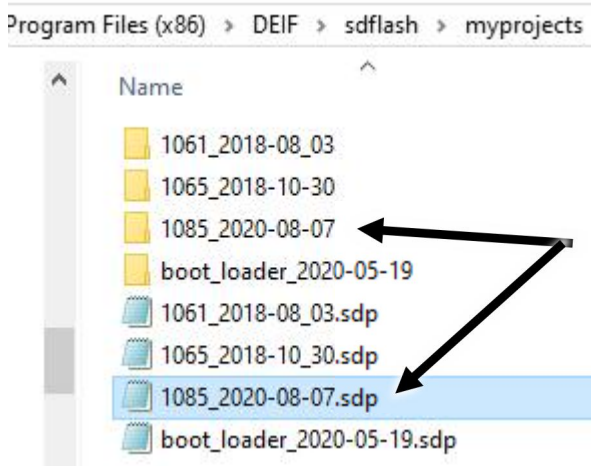
- The computer must be connected to the IMD with USB cable (male type A to male type B). 必须将计算机通过 USB 电缆 (A 型公头到 B 型公头) 连接到 IMD。
- Prepare the FW files for use. 准备固件文件以供使用。
 1. Copy the folder of the new FW. 复制新固件的文件夹。
 2. Paste the folder in the folder where other FW is located. If the FW files are located at their default location, go to `myprojects` folder in `sdfash` folder (where `sdfash` was installed) and paste the folder under `myprojects`.

NOTE The files can be located anywhere. It is possible to brows to the location and `sdfash` remembers this location.

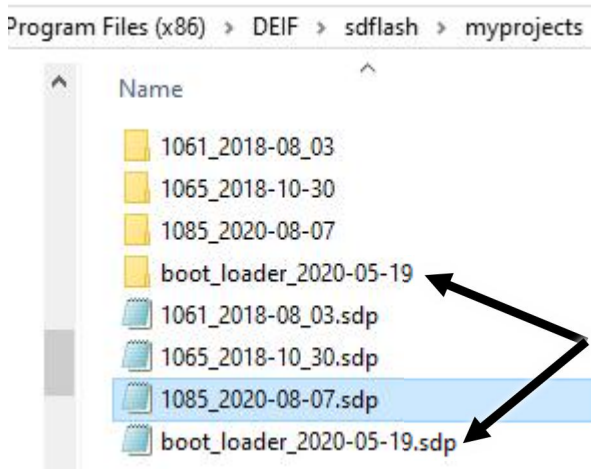
将文件夹粘贴到其他固件所在的文件夹中。如果固件文件位于其默认位置, 请转到 `sdfash` 文件夹 (安装 `sdfash` 的位置) 中的 `myprojects` 文件夹并将该文件夹粘贴到 `myprojects` 下。

注 文件可以存放在任何位置。可以浏览到该位置, `sdfash` 会记住该位置。

3. Copy any of the `.sdp` files in the folder and paste it. 复制文件夹中的所有 `.sdp` 文件并粘贴。
4. Rename the `.sdp` file to the same name as the new FW folder: 将 `.sdp` 文件重命名为与新 FW 文件夹相同的名称:



5. If there is no bootloader package in the folder, repeat the previous steps (1 to 4) for the bootloader:如果文件夹中没有引导加载程序包，请对引导加载程序重复前面的步骤（1至4）：

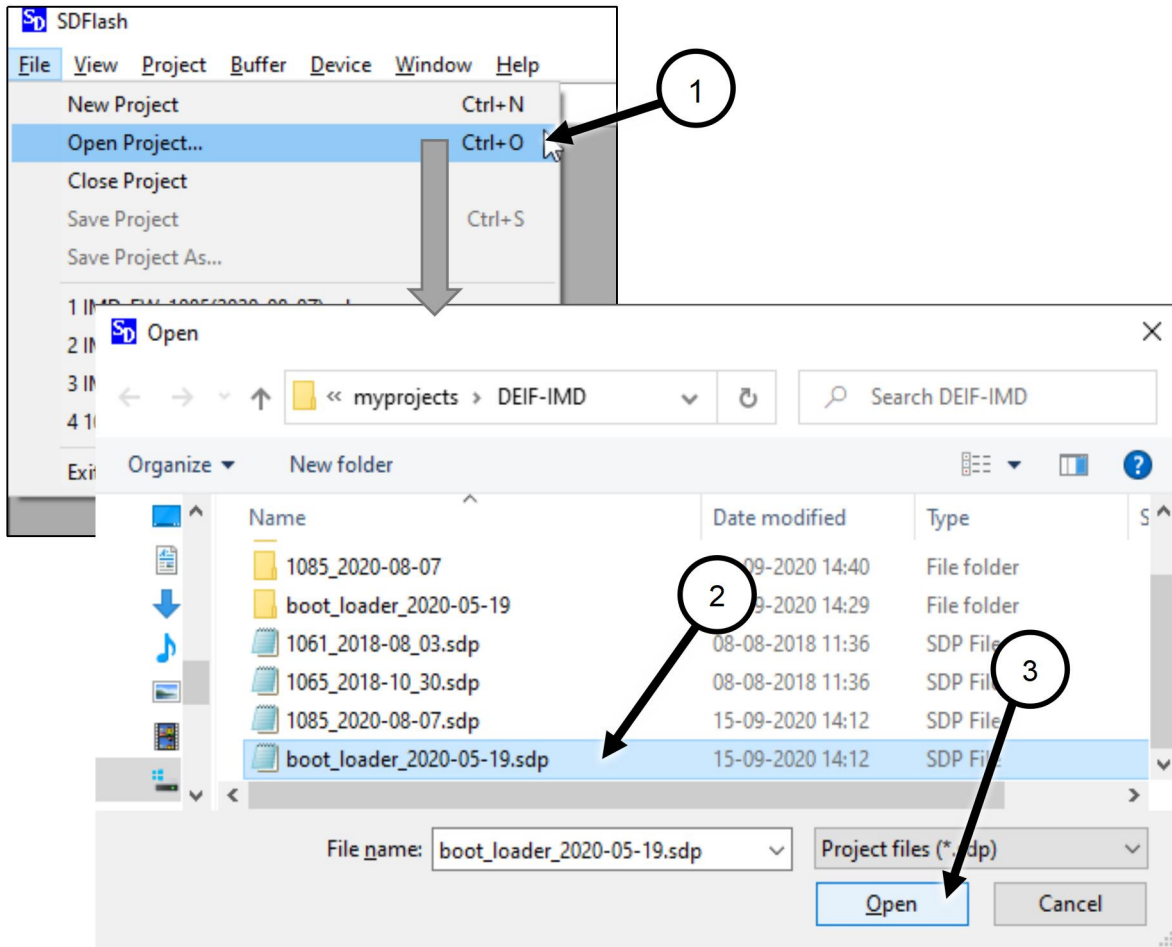


9.16.2.2 Updating CANopen bootloader file 更新 CANopen 引导加载程序文件

This task needs only to be done once, unless a newer bootloader version than the one already installed is available.此任务只需执行一次，除非有比已安装版本更新的引导加载程序版本可用。

1. Before turning the power to the IMD ON (24 V DC if the IMD does not have built-in power supply, or 400 V AC if it does have a built-in power supply), ensure that the RFE input is OFF to prevent the IMD from starting the motor unintentionally.接通 IMD 电源之前（如果 IMD 没有内置电源，则为 24 V DC；如果 IMD 有内置电源，则为 400 V AC），确保 RFE 输入已关闭，以防止 IMD 意外启动电机。
2. Connect the computer to the IMD Service connector with USB cable (male type A to male type B).使用 USB 电缆（A 型公头到 B 型公头）将计算机连接至 IMD 服务连接器。
3. Start the SDFlash if it is not started already.如果 SDFlash 尚未启动，则启动 SDFlash。
4. Click File→Open Project... (1), select and select the .sdp file that belongs to the bootloader package that should be installed (2), and click Open

点击 File→Open Project… (1)，选择需要安装的引导加载程序文件包中的.sdp 文件 (2)，点击 Open (3)：



(3):

5. Skip this step if the used Com port is known.

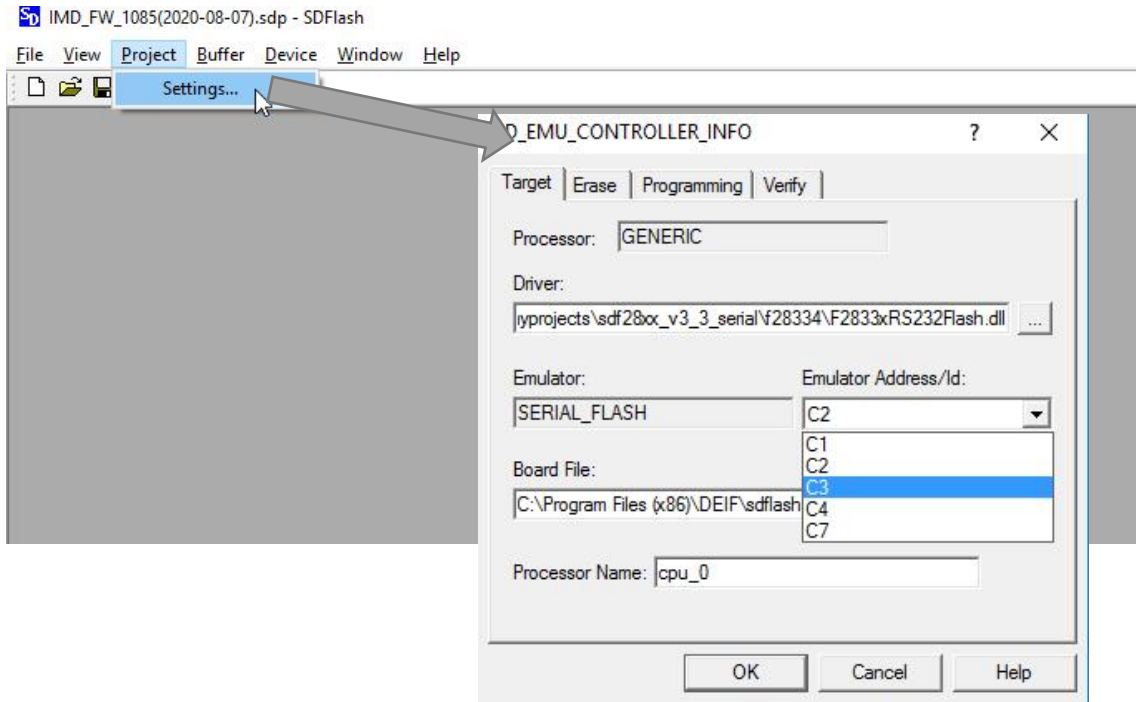
Open the “Device manager” in the computer’s “Settings” and determine which com port is used for the USB connection (the look and name of the device manager may differ depending on the operating system). Only Com1, Com2, Com3, and Com4 can be used with the SDFlash, if another port is selected by the system, you will need to change it so one of the mentioned ports is used:

如果已知使用的 Com 端口，则跳过此步骤。

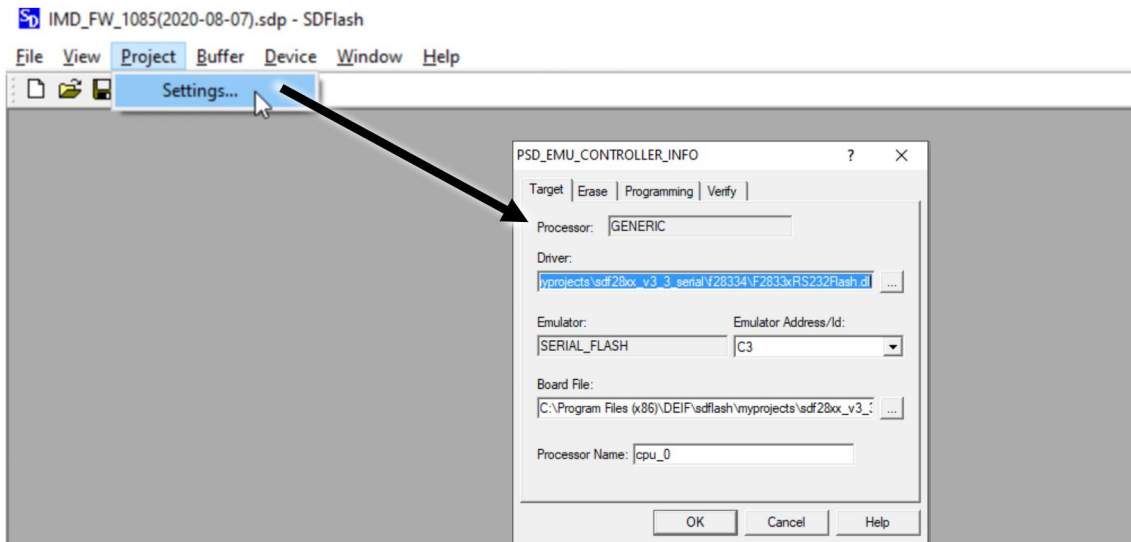
打开计算机“设置”中的“设备监控软件”，确定用于 USB 连接的 com 端口（设备监控软件的外观和名称可能因操作系统而异）。SDFlash 只能使用 Com1、Com2、Com3 和 Com4，如果系统选择了其他端口，则需要对其进行更改，以便使用上述端口之一：



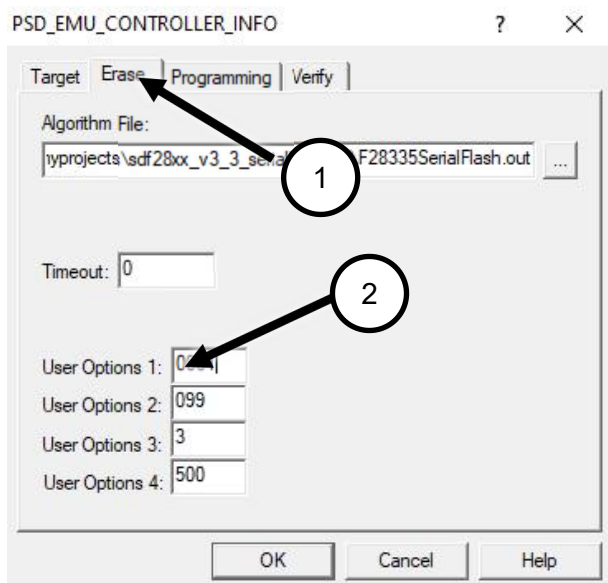
- 6. Click on Project →Settings... to open the Settings dialogue. Select the same com port as used in the device manager (COM1 → C1): 点击 Project Settings...打开 Settings 对话框。选择与设备监控软件(COM1 C1)相同的 com 端口:



- 7. Click on Project →Settings... to open the Settings dialogue. 点击 Project →Settings...打开 Settings 对话框。



- 8. Click on the “Erase” tab (1), and ensure that “User Options 1:” is set to “0001” (2): 点击 “Erase” 选项卡(1), 确保 “User Options 1:” 设置为 “0001” (2):

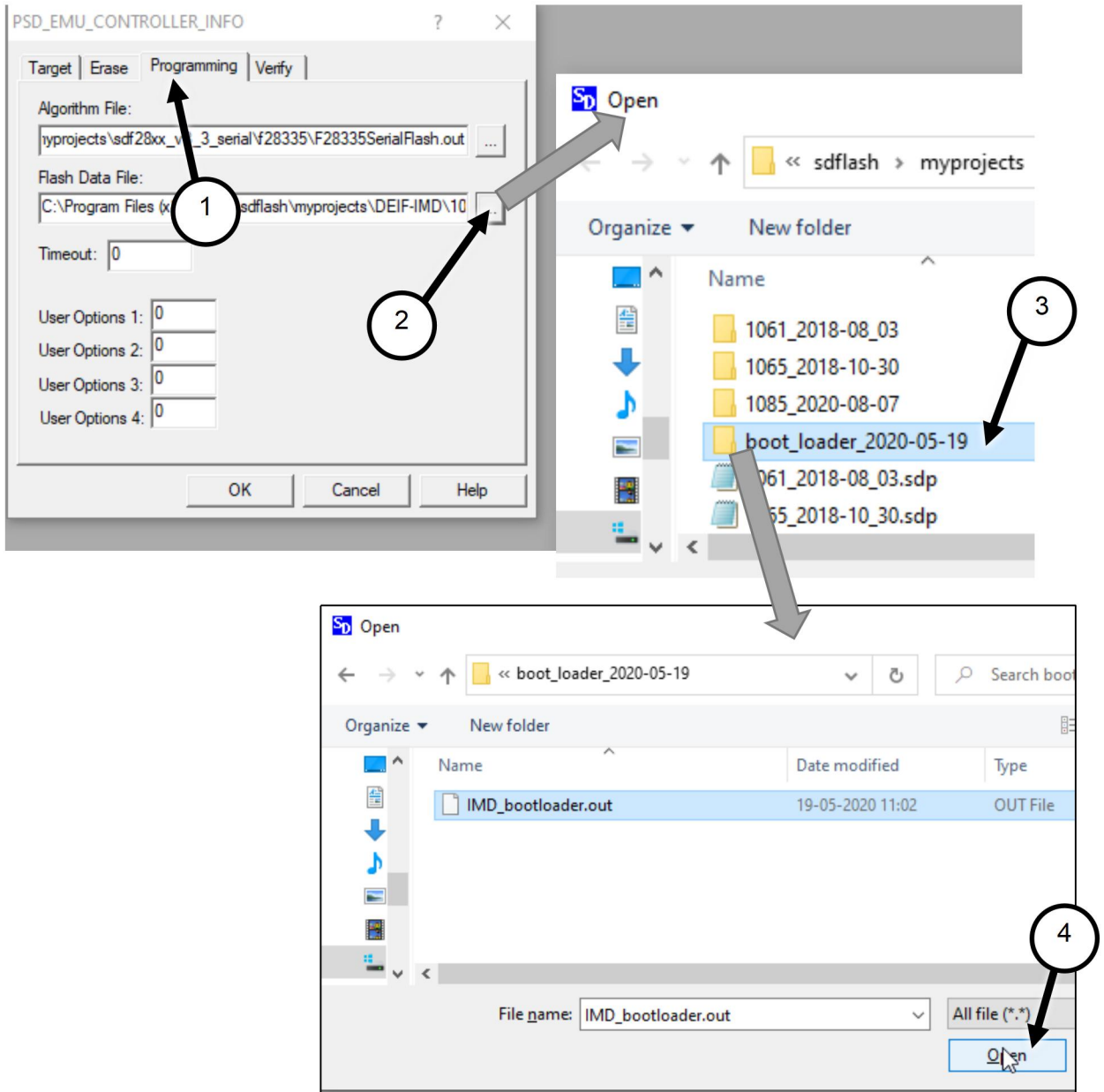


NOTE This step ensures that only the space allocated for the bootloader will be erased.

注：此步骤确保仅抹去为引导加载程序分配的空间。

9. Click on the “Programming” tab (1), then on the ... button of the Flash Data File (2), double click on the bootloader folder (3), select the IMD_bootloader.out file and click Open (4):

单击“编程”选项卡（1），然后在闪存数据文件的按钮上（2），双击引导加载程序文件夹（3），选择 IMD_bootloader.out 文件并单击打开（4）：



10. Click OK.单击“确定”。



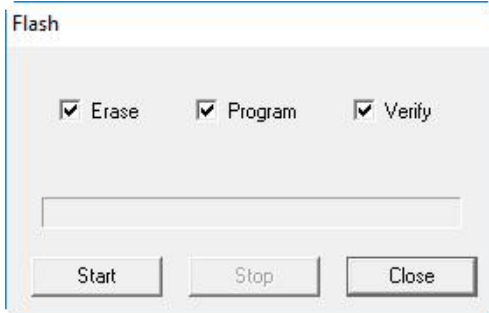
Info

If the com port or user option 1 was changed, you will be asked to save you project settings first, when attempting to update the bootloader in an IMD.

信息

如果 com 端口或用户选项 1 被更改，当尝试在 IMD 中更新引导加载程序时，您需要首先保存项目设置。

11. Set the IMD into programming mode by doing the following:将 IMD 设置为编程模式:
 - a. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) off. 关闭 24 V DC (如果内置 DC 电源, 则关闭 400 V AC)。
 - b. Set the CAN ID switch to position 15.关闭 24 V DC (如果内置 DC 电源, 则关闭 400 V AC)。
 - c. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) on.打开 24 V DC (如果内置 DC 电源, 则打开 400 V AC)。
12. Click on Device → Flash... to open the upgrade dialogue:点击 Device→ Flash...打开升级对话框:



13. Ensure that all three checkboxes are ticked and click Start. 确保勾选了所有三个复选框, 然后单击开始。
14. When the programming cycle is completed, click Close.编程循环完成后, 单击关闭。
15. Skip this step if the FW is to be update as well. 如果固件也需要更新, 则跳过此步骤。
Set the IMD back to normal operation mode:将 IMD 设置回正常操作模式:
 - a. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) off. 关闭 24 V DC (如果内置 DC 电源, 则关闭 400 V AC)。
 - b. Set the CAN ID switch back to its original position.将 CAN ID 开关设置回其原始位置。
 - c. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) on. Note that the first startup after firmware upgrade might take longer (up to approximately 10 s). 打开 24 V DC (如果内置 DC 电源, 则打开 400 V AC)。请注意, 固件升级后的首次启动可能需要更长的时间 (最多约 10 秒)。
16. The IMD is now updated.IMD 现已更新。



Info

On rare occasions, The SDflash program will show a “Connection error” after step [11](#) on page [204](#) is executed. In such a case, it is necessary to restart the whole process:

信息

在极少数情况下, 执行第 156 页的步骤 11 后, SDFlash 程序将显示“连接错误”。在这种情况下, 有必要重新启动整个过程:

6. Close the SDflash program 关闭 SDflash 程序
7. Turn off the IMD 关闭 IMD
8. Start the SDflash 启动 SDflash
9. Turn on the IMD 启动 IMD
10. Repeat com configuration, and the actions described in steps [4](#) on page [200](#) to [13](#) on page [204](#) . 重复 com 配置和第 153 页第 4 步至第 156 页第 13 步中描述的操作。

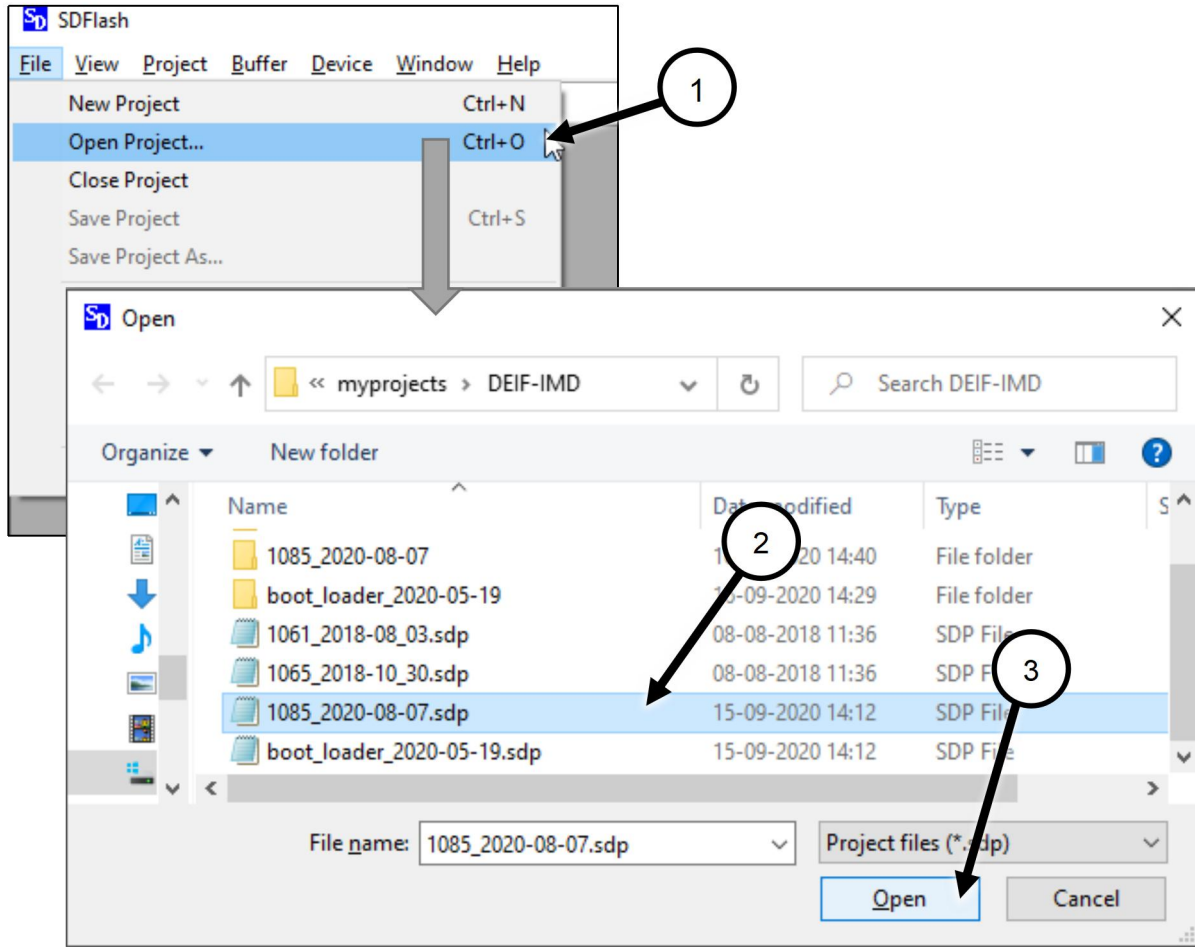
9.16.2.3 *Updating CANopen FW file 更新 CANopen FW 文件*

This procedure describes how to update the IMD FW in an IMD prepared for CANopen FW update, through the Service USB connector.

本程序描述了如何通过服务 USB 连接器在为 CANopen FW 更新准备的 IMD 中更新 IMD 固件。

1. Skip this step if the SDFlash is started, and IMD is already turned on in programming mode 如果 SDFlash 已启动，且 IMD 已在编程模式下打开，则跳过此步骤
 - a. Before turning the power to the IMD ON (24 V DC if the IMD does not have built-in power supply, or 400 V AC if it does have a built-in power supply), ensure that the RFE input is OFF to prevent the IMD from starting the motor unintentionally. 接通 MD 电源之前（如果 IMD 没有内置电源，则为 24 V DC；如果 IMD 有内置电源，则为 400 V AC），请确保 RFE 输入已关闭，以防止 IMD 意外启动电机。
 - b. Start the SDFlash if it is not started already. 如果 SDFlash 尚未启动，则启动 SDFlash。
 - c. Set the IMD into programming mode by doing the following: 通过执行以下操作将 IMD 设置为编程模式：
 - i. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) off. 关闭 24 V DC（如果内置 DC 电源，则关闭 400 V AC）。
 - ii. Set the CAN ID switch to position 15. 将 CAN ID 开关设置到位置 15。
 - iii. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) on. 打开 24 V DC（如果内置 DC 电源，则打开 400 V AC）。
2. Click File→Open Project... (1), select and select the .sdp file that belongs to the FW that should be installed (2) and click Open 点击 File→Open Project...（1），选择需要安装的 FW 中的 .sdp 文件（2）点击

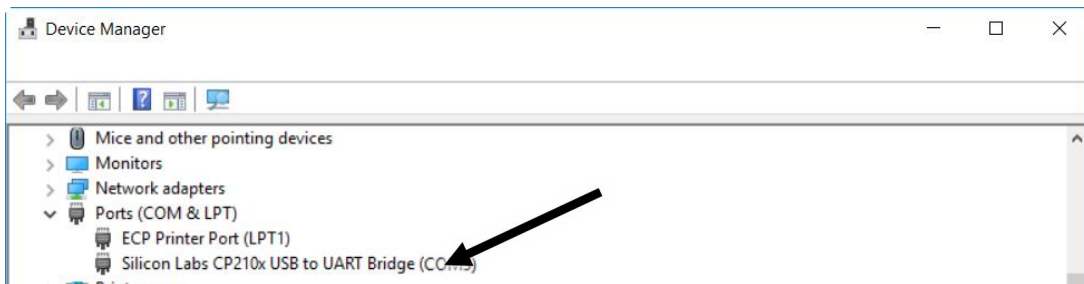
Open



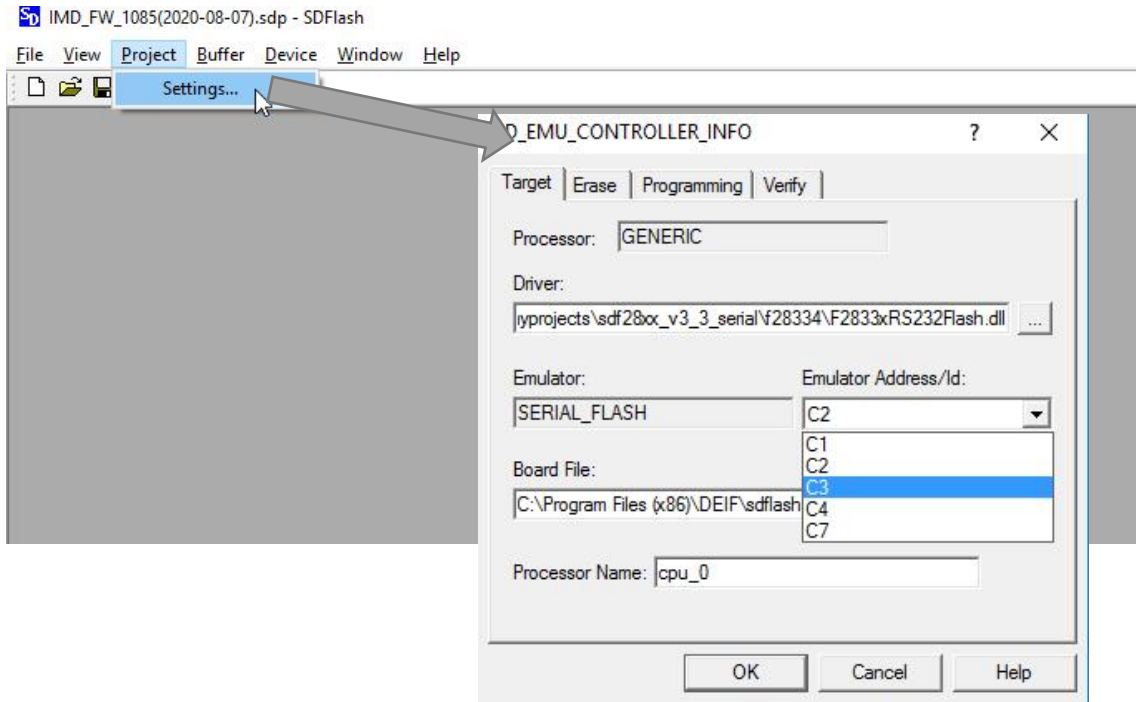
- 3. Skip this step if the used Com port is known. Open the “Device manager” in the computer’s “Settings” and determine which com port is used for the USB connection (the look and name of the device manager may differ depending on the operating system). Only Com1, Com2, Com3, and Com4 can be used with the SDFlash, if another port is selected by the system, you will need to change it so one of the mentioned ports is used:

如果已知使用的 Com 端口，则跳过此步骤。

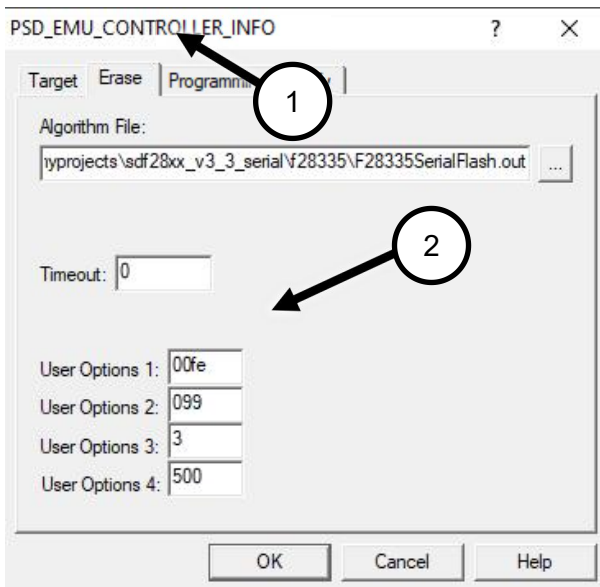
打开计算机“设置”中的“设备监控软件”，确定用于 USB 连接的 com 端口（设备监控软件的外观和名称可能因操作系统而异）。SDFlash 只能使用 Com1、Com2、Com3 和 Com4，如果系统选择了其他端口，则需要对其进行更改，以便使用上述端口之一：



- Click on Project →Settings... to open the Settings dialogue. Select the same com port as used in the device manager (COM1 → C1): 点击 Project →Settings... 打开 Settings 对话框。选择与设备监控软件中使用的相同的 com 端口 (COM1 C1)



- Click on the “Erase” tab (1), and ensure that “User Options 1:” is set to “00fe” (2):
点击 “Erase” 选项卡(1), 确保 “User Options 1:” 设置为 “00fe” (2):

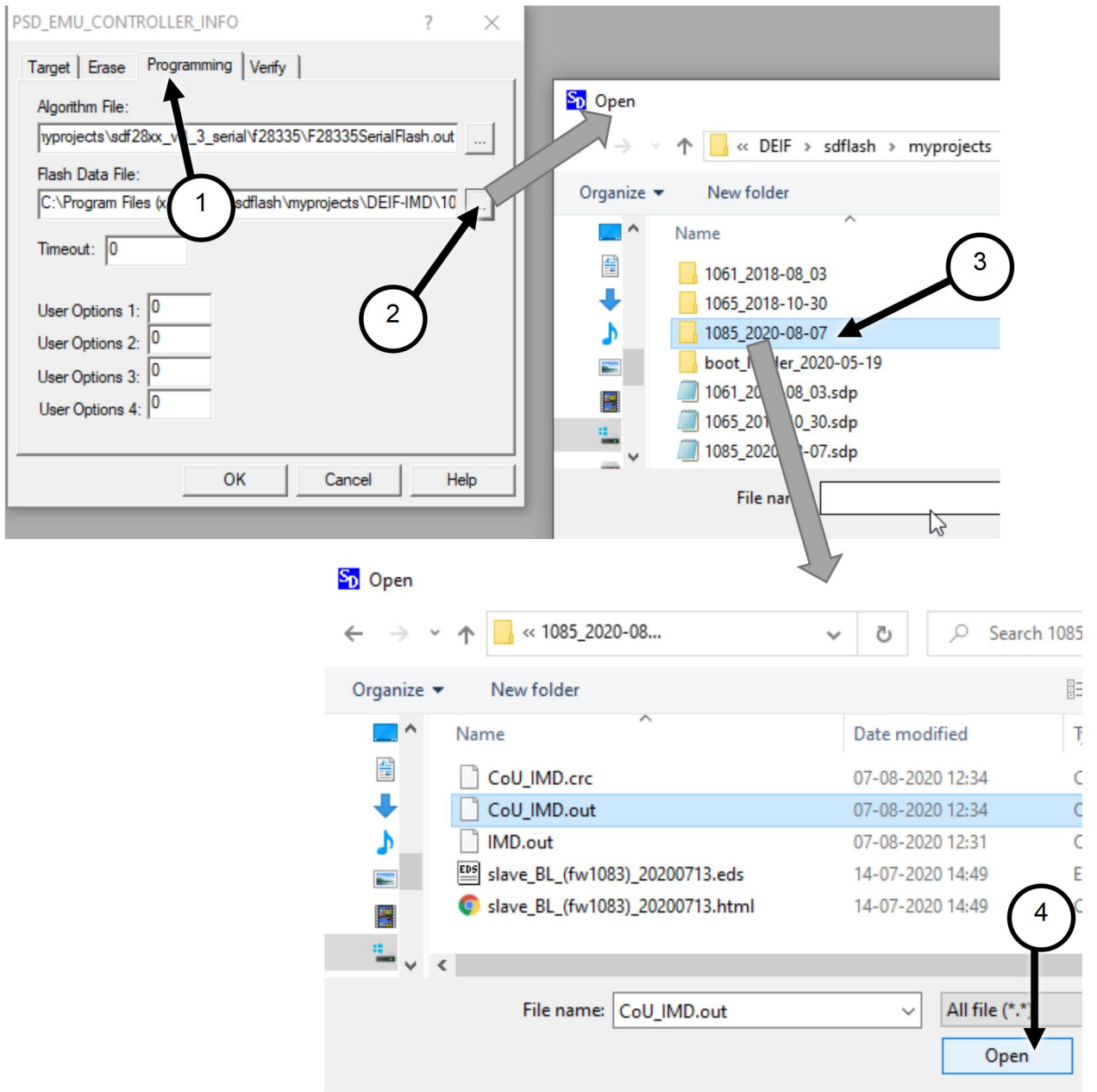


NOTE This step ensures that the bootloader already installed will not be erased.

注：此步骤确保已安装的引导加载程序不会被抹去。

- Click on the “Programming” tab (1), then on the ... button of the Flash Data File (2), double click on the FW folder (3), select the CoU_IMD.out file and click Open (4):

单击 “编程” 选项卡 (1), 然后在闪存数据文件的按钮上 (2), 双击 FW 文件夹 (3), 选择 CoU_IMD.out 文件并单击打开 (4):



7. Click OK.单击“确定”。



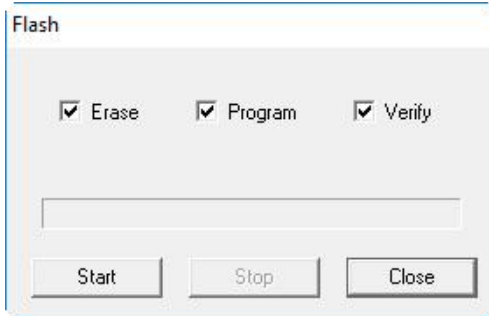
Info

If the com port or user option 1 was changed, you will be asked to save you project settings first, when attempting to upgrade the firmware in an IMD.

信息

如果 com 端口或用户选项 1 被更改，当尝试在 IMD 中更新固件时，您需要首先保存项目设置。

8. Click on Device → Flash... to open the upgrade dialogue: 点击 Device Flash... 打开升级对话框:



9. Ensure that all three checkboxes are ticked and click Start. 确保所有三个复选框都已勾选，然后单击 Start。

10. When the programming cycle is completed, set the IMD back to normal operation mode: 编程完成后，将 IMD 设置为正常操作模式:

- a. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) off. 关闭 24 V DC (如果内置 DC 电源，则关闭 400 V AC)。
- b. Set the CAN ID switch back to its original position. 将 CAN ID 开关设置回其原始位置。
- c. Turn the 24 V DC (or the 400 V AC if the DC power supply is built-in) on. Note that the first startup after firmware upgrade might take longer (up to approximately 10 s). 打开 24 V DC (如果内置 DC 电源，则打开 400 V AC)。请注意，固件升级后的首次启动可能需要更长的时间 (最多约 10 秒)。

11. The IMD is now updated. IMD 现已更新。



Info

On rare occasions, The SDFlash program will show a “Connection error” after step [11](#) on page [204](#) is executed. In such a case, it is necessary to restart the whole process:

信息

在极少数情况下，执行第 156 页的步骤 11 后，SDFlash 程序将显示“连接错误”。在这种情况下，有必要重新启动整个过程:

11. Close the SDflash program 关闭 SDflash 程序
12. Turn off the IMD 关闭 IMD
13. Start the SDflash 启动 SDflash
14. Turn on the IMD 启动 IMD
15. Repeat com configuration, and the actions described in steps [4](#) on page [200](#) to [13](#) on page [204](#). 重复 com 配置和第 153 页第 4 步至第 156 页第 13 步中描述的操作。

9.16.3 Updating firmware through CANopen 通过 CANopen 更新固件

9.16.3.1 Prerequisites 先决条件

- A specific “FW updater” SW must be implemented (by the customer) in the Pitch Motion Controller, or Turbine Controller (see section [7.1.3.5](#) on page [99](#) for implementation details). 必须 (由客户)

在变桨控制器或风机主控制器中实施特定的“固件更新程序”软件（实施详情见第 76 页第 7.1.3.5 节）。

- Instructions on how to use the implemented “FW updater” SW available 有关如何使用已实施的“固件更新程序”软件的说明
- Bootloader for CANopen FW update is installed on the IMD (see section [9.16.2.2](#) on page [206](#)) CANopen FW 更新引导加载程序安装在 IMD 上（见第 157 页第 9.16.2.2 节）
- The turbine must be stopped in a safe position and all blades are in fully feathered position. 风机必须停在安全位置并且所有叶片都处于完全顺桨位置。

9.16.3.2 Updating the firmware 更新固件

1. Update the firmware according the “FW updater” instructions 根据“FW updater”说明更新固件
2. When all IMDs are updated the turbine can be restarted 当所有 IMD 更新时，可以重新启动风机

9.17 Using digital inputs and outputs 使用数字输入和输出

The digital inputs and outputs are not dependent on the state of the IMD. It is possible to read the state of a digital input or output, as well as set or reset a digital output no matter which operational state the IMD is in. Digital outputs D5 to D8 as well as digital inputs 1 and 2 can be also be controlled by mapping (assigning) logical function to them. When this is done, an output will change state or a function will be activated/deactivated when an input change state. See section [8.4.8](#) on page [133](#) and the description of how to use in the IMD Manager user manual.

数字输入和输出不取决于 IMD 的状态。无论 IMD 处于何种操作状态，都可以读取数字输入或输出的状态，以及设置或重置数字输出。数字输出 D5 到 D8 以及数字输入 1 和 2 也可以通过映射（分配）逻辑功能来控制。完成此操作后，当输入改变状态时，输出将改变状态或功能将被激活/停用。请参阅第 100 页第 8.4.8 节和 IMD 监控软件用户手册中的使用说明。

9.17.1 Digital outputs 数字输出

This section describes how to use the digital outputs. 本节介绍如何使用数字输出。

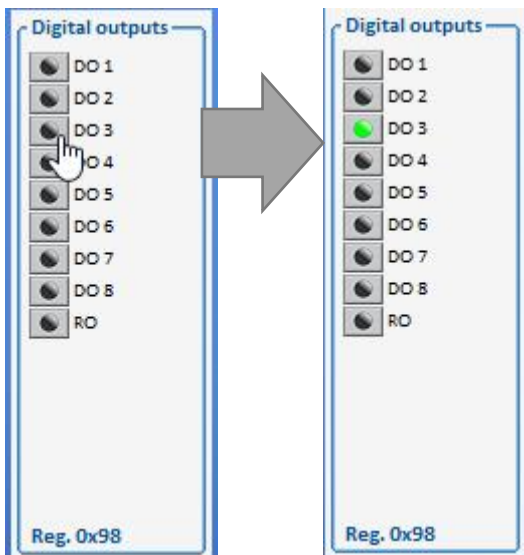
9.17.1.1 Prerequisites 先决条件

None 无

9.17.1.2 Activation 激活

IMD Manager: Click on the “DO x” button of the digital output to toggle it:

IMD 监控软件: 点击数字输出的“DO x”按钮进行切换:



CAN/CANopen: Set the applicable bit in Reg. 0x98 (see section [13.2.8](#) on page [276](#) for bit mapping) to “1” (on).

CAN/CANopen: 设置 Reg.0x98 中的适用位（有关位映射，请参阅第 211 页第 13.2.8 节）到 “1”（开启）。

9.17.1.3 Operation 操作

IMD Manager: The state of all digital outputs is represented by LED in the “Monitor and control” tab. The LED is turned ON when the output is ON, and Off when the output is Off.

IMD 监控软件器: “监控”选项卡中的 LED 指示灯表示所有数字输出的状态。LED 在输出打开时点亮，在输出关闭时熄灭。

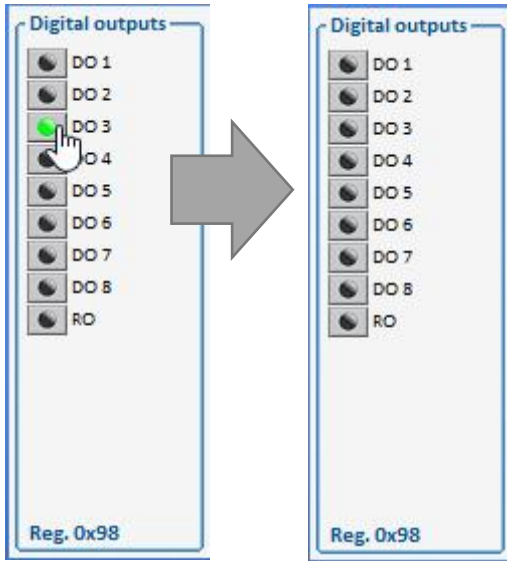
CAN/CANopen: The state of all digital inputs can be retrieved from object 2098 (see section [13.2.8](#) on page [276](#) for bit mapping).

CAN/CANopen: 可以从对象 2098 中检索所有数字输入的状态（有关位映射，请参见第 211 页上的第 13.2.8 节）。

9.17.1.4 Deactivation 停用

IMD Manager: Click on the “DO x” button of the digital output to toggle it:

IMD 监控软件: 点击数字输出的 “DO x” 按钮进行切换:



CAN/CANopen: Reset the applicable bit in object 2098 (see section [13.2.8](#) on page [276](#) for bit mapping) to “0” (Off).

CAN/CANopen: 将对象 2098 中的适用位（位映射见第 211 页第 13.2.8 节）重置为 “0”（关闭）。

9.17.2 Digital inputs 数字输入

This section describes how to use the digital inputs. 本节介绍如何使用数字输入。

9.17.2.1 Prerequisites 先决条件

None 无

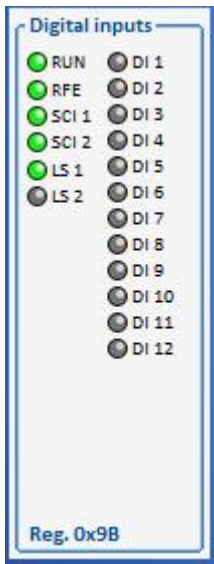
9.17.2.2 Activation 激活

None 无

9.17.2.3 Operation 操作

IMD Manager: The state of all digital inputs is represented by LED in the “Monitor and control” tab. The LED is turned ON when the input is high, and Off when the input is low.

IMD 监控软件: “监控” 选项卡中的 LED 指示灯表示所有数字输入的状态。LED 在输入高时点亮, 在输入低时熄灭。



CAN/CANopen: The state of all digital inputs can be retrieved from object 209B (see section [13.2.9](#) on page [277](#) for bit mapping).

CAN/CANopen: 可以从对象 209B 中检索所有数字输入的状态（有关位映射，请参见第 212 页上的第 13.2.9 节）。

9.17.2.4 *Deactivation* 停用

None.无

9.18 Using SSI Encoder to determine blade position 使用 SSI 编码器确定叶片位置

9.18.1 Retrieving position from single-turn encoder 从单转编码器检索位置

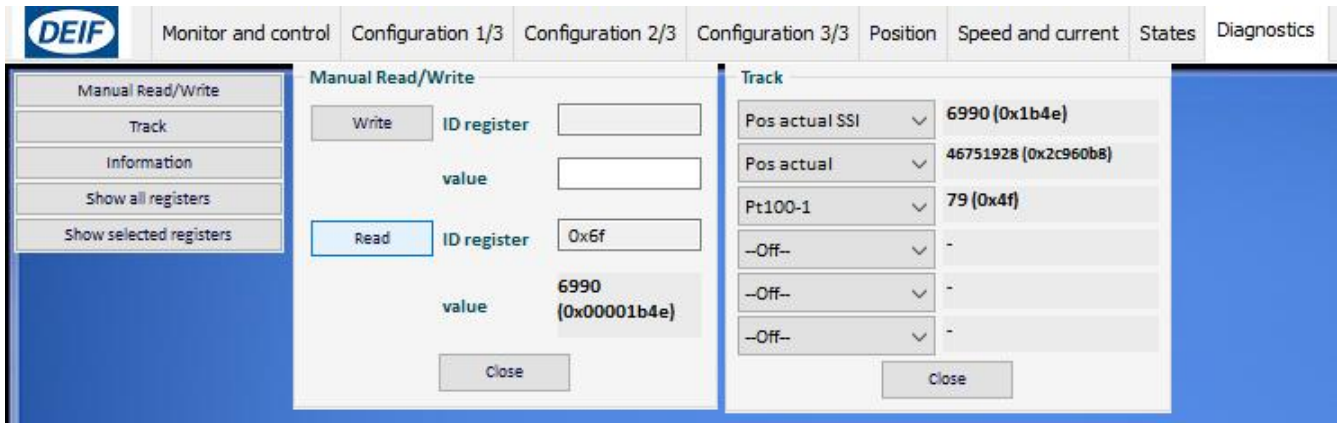
The position can be read directly in the “Actual position” group in “Monitor and control” tab. The values shown automatically changes according to selected type of the encoder. Example of single-turn encoder:

可在“监控”选项卡的“实际位置”组中直接读取位置。显示的值会根据所选编码器类型自动更改。单圈编码器示例：

Actual position			
	Reg. value	Revolution pos.	Special bit
SSI encoder	6664	3332	0

The SSI encoder value can also be retrieved by reading the register 0x6F either through CAN / CANopen or in the “Diagnostics” tab “Manual Read/Write” or “Track”.

SSI 编码器值也可以通过 CAN/CANopen 或“诊断”选项卡中的“手动读/写”或“跟踪”读取寄存器 0x6F 来检索。



The data format is as follows:数据格式如下:

Bits 位 15...13	Bits 位 (MSB) 12...01 (LSB)	Bit 位 0
Padding 填充	Position value 位置值	Special bit 特殊位

In the example above the decimal reading is 6990. An even number indicates that the special bit is 0. The position value is $INT(6990/2) = 3495$ (only the integer portion of the result is used, 6991 will give the same result). See encoder’s manufacturer documentation for interpretation of the special bit.

在上述示例中，十进制读数为 6990。偶数表示特殊位为 0。

位置值为 $INT(6990/2) = 3495$ （仅使用结果的整数部分，6991 将给出相同的结果）。有关特殊位的解释，请参阅编码器制造商文档。

9.18.2 Retrieving position multi-turn encoder 检索多转编码器位置

The position can be read directly in the “Actual position” group in “Monitor and control” tab. The values shown automatically changes according to selected type of the encoder.

Example of multi turn encoder:

可在“监控”选项卡的“实际位置”组中直接读取位置。显示的值会根据所选编码器类型自动更改。

多转编码器示例:

Actual position			
	Reg. value	Revolution pos.	No. of Revolutions
SSI encoder	10453956	964	2552

The SSI encoder value can also be retrieved by reading the register 0x6F, either through CAN / CANopen or in the IMD Manager.

The data format is as follows:

SSI 编码器值也可以通过读取寄存器 0x6F，通过 CAN/CANopen 或在 IMD 监控软件中检索。

数据格式如下:

Bits 位 31...25	Bits 位 (MSB) 24...13 (LSB)	Bits 位 (MSB) 12...00 (LSB)
Padding 填充	Number of revolutions value 转	Position value 位置值

	数值	
--	----	--

In the IMD Manager this is done in the “Diagnostics” tab either by manually reading 0x6F or by using the “Track” function and setting it to “Pos actual ssi”:在 IMD 监控软件中，可以在“诊断”选项卡中手动读取 0x6F 或使用“Track”功能并将其设置为“Pos actual ssi”：

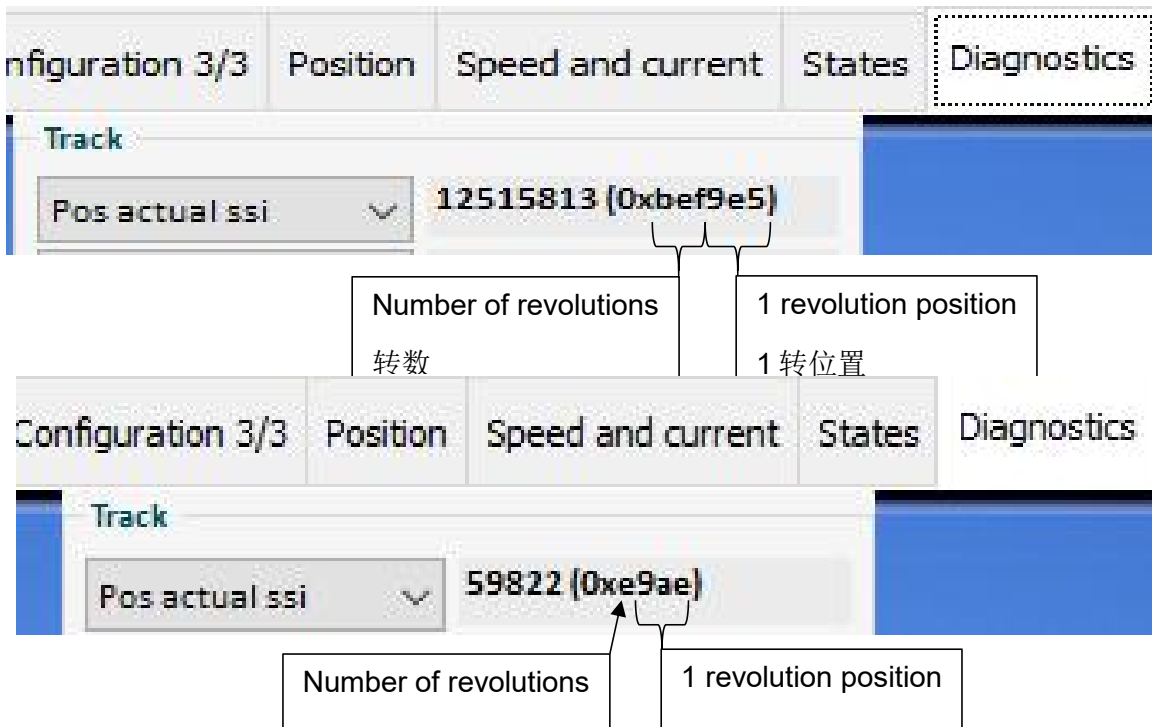


Figure 43 Examples of two readings of multi-turn SSI values using Track

图 43 使用 Track 读取多转 SSI 值的两个示例

In the first example above, the hexadecimal reading is 0xBEF9E5.

The position value is the lower 3 hexadecimal digits: 0x9E5 = 4745 (decimal).

The number of revolutions is the higher 3 hexadecimal digits (or fewer depending on the value) 0xBEF = 5757 (decimal).

In the second example the hexadecimal reading is 0xE9AE.

The position value is the lower 3 hexadecimal digits: 0x9AE = 2478 (decimal).

The number of revolutions is the higher 3 hexadecimal digits (or fewer depending on the value) 0xE = 14 (decimal).

在上面的第一个示例中，十六进制读数是 0xBEF9E5。

位置值是较低的 3 个十六进制数字：0x9E5 = 4745（十进制）。

转数是较高的 3 个十六进制数字（或更少，取决于值）

0xBEF = 5757（十进制）。

在第二个示例中，十六进制读数为 0xE9AE。

位置值是较低的 3 个十六进制数字：0x9AE = 2478（十进制）。

转数是较高的 3 个十六进制数字（或更少，取决于值）

0xE = 14（十进制）。



Info

Even though the format of the encoder data transmission is gray code, it is translated to binary format before it is saved in the IMD register.

After a value of FFF, the next value of number of revolutions (FFF+1) will be zero.

信息

尽管编码器数据传输的格式是格雷码，但在保存到 IMD 寄存器之前，它被转换为二进制格式。

在 FFF 值之后，下一个转数值（FFF+1）将为零。

9.19 Retrieving error additional information (error snapshot)

检索错误附加信息（错误快照）

The error snapshot function records additional information about the conditions just before the last error occurred. The records are saved in the RAM of the IMD as an oscilloscope capture. However, it is not possible to view the records in the IMD manager oscilloscope. The parameter set for recording is chosen to provide maximum of information in the event of a fault, and cannot be changed.

The settings of the built-in oscilloscope are automatically set when the IMD starts. A capture is made in the event of every error except for RFE missing. The recorded information always start before the error event, in order to have information about the conditions leading to the error. If the oscilloscope is used through the IMD manager, these settings are overwritten and the snapshot function is disabled, until the IMD restarts.

When an error occurs, the IMD saves the information in the RAM. The recorded information must be exported manually. If the oscilloscope is used before the snapshot information is exported, the information is lost.

The data is recorded as raw data of the registers. Some data is given as hexadecimal (indicated with 0x), and some as decimal. The exported information is exported in two files:

错误快照功能记录上一次错误发生前的其他有关情况的信息。记录作为示波器捕获保存在 IMD 的 RAM 中。但是，无法在 IMD 监控软件示波器中查看记录。选择用于记录的参数集是为了在发生故障时提供最大限度的信息，并且不能更改。

内置示波器的设置在 IMD 启动时自动设置。在发生除 RFE 缺失外的所有错误时都会进行捕获。记录的信息总是在错误事件之前开始，以便获得关于导致错误的条件的信息。如果通过 IMD 管理器使用示波器，这些设置将被覆盖，快照功能将被禁用，直到 IMD 重新启动。

当发生错误时，IMD 将信息保存在 RAM 中。记录的信息必须手动导出。如果在导出快照信息之前使用示波器，则信息会丢失。

数据被记录为寄存器的原始数据。一些数据以十六进制表示（用 0x 表示），一些以十进制表示。导出的信息导出到两个文件中：

- A .csv file containing all the recorded error history information as well as the capture information
包含所有记录的错误历史信息以及捕获信息的 .csv 文件
- A .txt file containing the oscilloscope settings and capture
包含示波器设置和捕获的.txt 文件

9.19.1 Prerequisites 先决条件

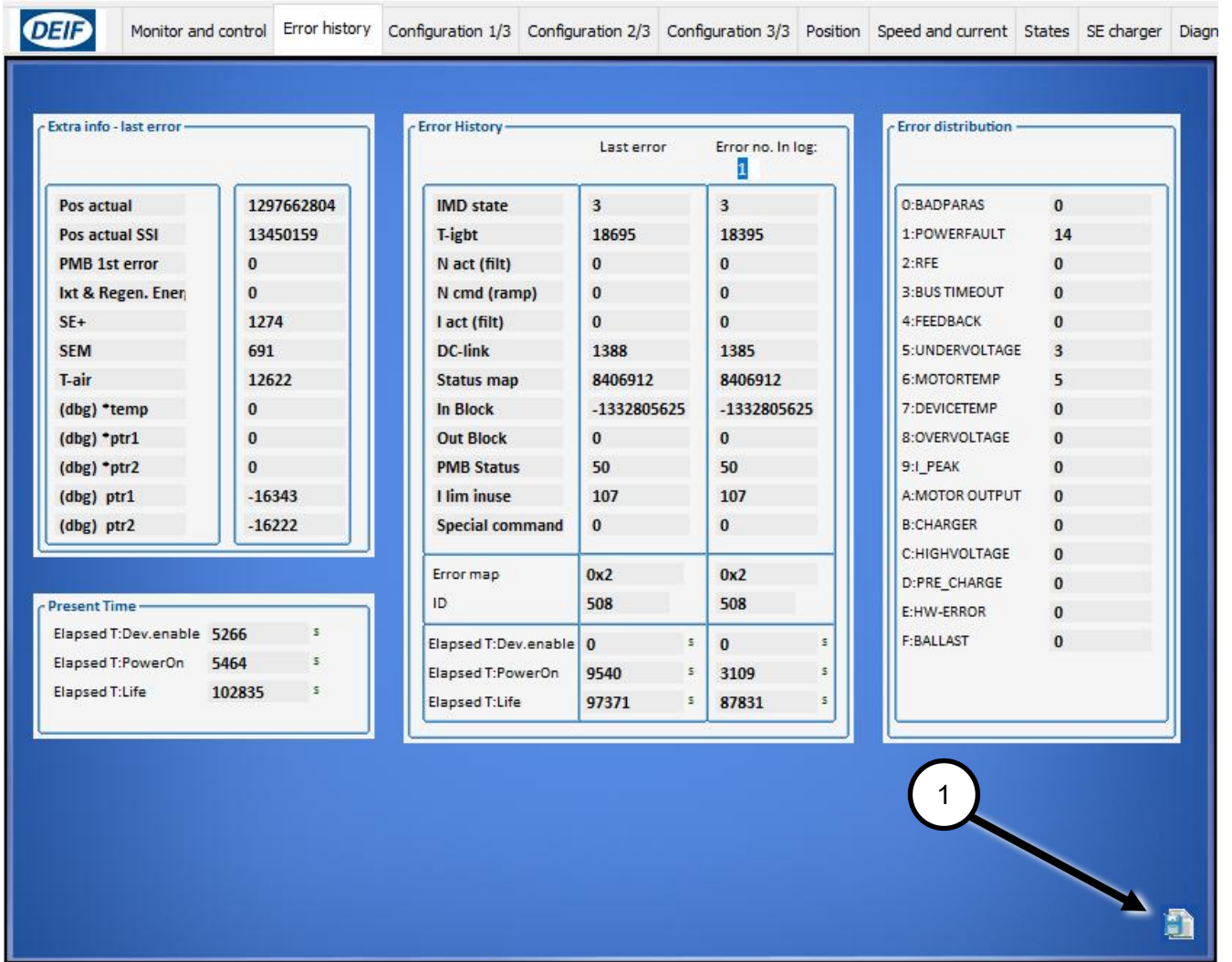
- The IMD FW is 1-08-9 or later
IMD FW 为 1-08-9 或更高版本
- The oscilloscope was not used since the IMD started
自 IMD 启动后，未使用示波器
- IMD manager is available, to be able to export the information
IMD 监控软件可用，可以导出信息


9.19.2 Activation 激活


The activation of the error snapshot is automatic, whenever an error occurs except for RFE missing (error 2). 无论何时发生错误（RFE 缺失除外）（错误 2），错误快照都会自动激活。


9.19.3 Operation 操作

1. After the error, export the data by clicking in the icon in the Error history tab of the IMD manager (1):出现错误后，通过单击 IMD 监控软件中的错误历史选项卡中的图标导出数据（1）：

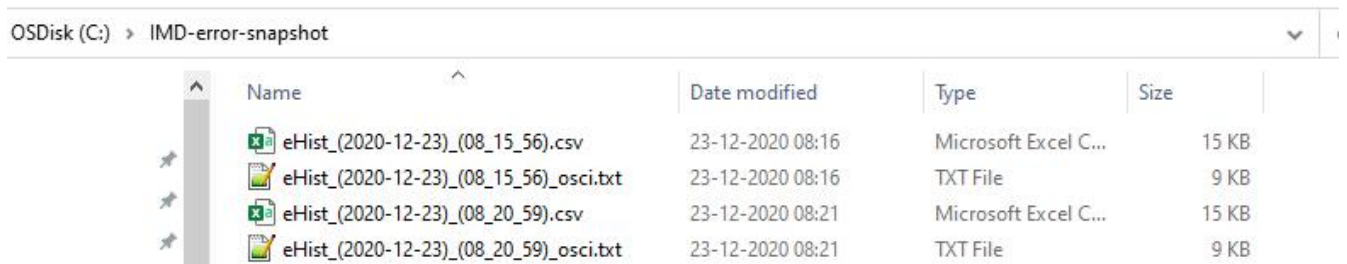


The icon changes to  and the “Error no. in log” counts up through all the recorded errors in the error history. This may take some time.

图标变为  并且“Error no.in log” 对错误历史记录中所有记录的错误进行计数。这可能要花点时间。

When the icon changes back to , the two files are saved in C:\IMD-error-snapshot folder:

当图标变回  时，将这两个文件保存在 C:\IMD-error-snapshot 文件夹中：



Each file name contains a date and time stamp, and contains the parameters values, and all data from all errors in the Error history log.每个文件名都包含一个日期和时间戳，并包含参数值，以及错误历史记录日志中所有错误的所有数据。

2. The data can be processed with any tool available.可使用任何可用工具处理数据。

9.19.4 Deactivation 停用

The snapshot function is deactivated if the oscilloscope in the IMD manager is used.

如果使用 IMD 监控软件中的示波器，快照功能将停用。

10. Units conversion 单位转换

All values read from and sent to the IMD are in raw unformatted numbers. This section describes how to convert from raw values to units such as Ampere, Volt and so on.

从 IMD 读取和发送到 IMD 的所有值都是原始的未格式化数字。本节介绍如何将原始值转换为安培、伏特等单位。

10.1 Converting position values 转换位置值

The actual position is stored in register 0x6D with a value from the resolver. The value is signed 32 bit, where the low 16 bits is the position (angle) within one revolution and the high 16 bits are the number of revolutions inclusive direction (plus or minus). The number of revolutions is a cumulative value.

实际位置与来自解析器的值一起存储在寄存器 0x6D 中。该值是带符号的 32 位，其中低 16 位是一转内的位置（角度），高 16 位是包含方向（正或负）的转数。转数是累积值。

10.2 Converting voltage units to volts 将电压单位转换为伏特

Voltage measurements of the internal DC bus and safe energy (batteries or ultra-caps) are retrieved as units. To convert unit values to volts, use the following formulas: 内部直流母线和后备电源（电池或超级电容）的电压测量值作为单位进行检索。要将单位值转换为伏特，请使用以下公式：

Measurement 测量	Register 寄存器	Formula 公式
DC-link voltage 直流母线电压	0xEB	Volts value = Reg. 0xEB value / 29.8901 伏特值 = Reg.0xEB 值 / 29.8901
Safe energy voltage 后备电源电压	0x66	Volts value = Reg. 0x66 value / 59.569 伏特值 = Reg.0x66 值 / 59.569

10.3 Converting temperature values 转换温度值

The different sensors have different coefficients and different full scale. Therefore, different tables are needed for the conversion. The conversion is done as a temperature interval linear interpolation.

不同的传感器具有不同的系数和不同的满量程。因此，转换需要不同的表。转换是作为温度区间线性插值完成的。

10.3.1 Converting power module temperature (T-igbt) 转换电源模块温度 (T-igbt)

The temperature of the power module can be read from register [0x4A](#) or CANopen object 204A. In the following description, the actual temperature read, is called **Actual_temp_raw**.

The following data is needed for the conversion (Temperature is in °C):

电源模块的温度可以从寄存器 0x4A 或 CANopen 对象 204A 中读取。在以下描述中，实际读取的温度称为 Actual_temp_raw。

Table 24 Raw IGBT temperature values (NTC)

表 24 原始 IGBT 温度值 (NTC)

i	Raw_value 原始值	Temperature 温度
1	16333	-30
2	16515	-20
3	16791	-10
4	17190	0
5	17737	10
6	18447	20
7	19323	30
8	20343	40
9	21469	50
10	22647	60
11	23823	70
12	24946	80
13	25981	90
14	26906	100



Info

The NTC sensor data is defined down to -30°C.

信息

NTC 传感器数据定义为低至 -30° C。

When converting a temperature given in raw values to centigrade, the interval **i** must be found. Select the first interval (table row) where the **Raw_value** is smaller than the **Actual_temp_raw**.

将原始值中给出的温度转换为摄氏度时，必须找到区间 **i**。选择原始值小于实际温度原始值的第一个区间(表行)。

Formula:公式

Actual temperature °C = 实际温度摄氏度

$$Temperature \text{ 温度 } [i] + \frac{(Actual_temp_raw - Raw_value[i]) * (temperature [i+1] - temperature [i])}{Raw_value[i+1] - Raw_value[i]}$$

Example of converting a value of 24000 units to °C:

将 24000 个单位的值转换为 °C 的示例:

$$70 + \frac{(24000 - 23823) * (80 - 70)}{24946 - 23823} = 71.6$$

24000 units = 71.6 °C

Actual_temp_raw 实际温度原始值= 24000

i = row 11 is selected 选择第 11 行

Temperature 温度[i] = 70

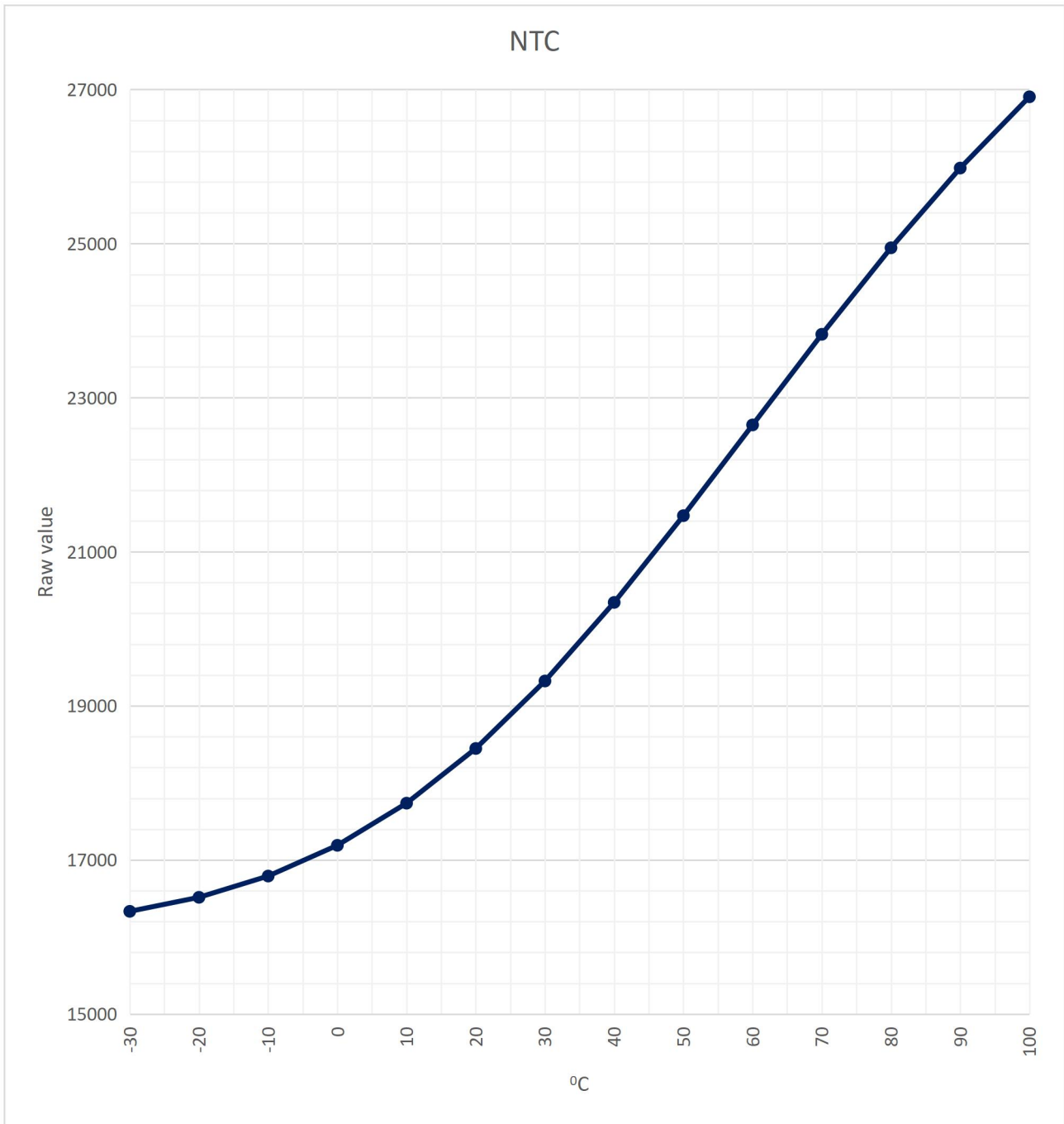
Temperature 温度[i+1] = 80

Raw_value 原始值[i] = 23823

Raw_value 原始值[i+1] = 24946

10.3.1.1 Quick conversion chart 快速转换图

The following chart gives a quick view of temperature vs. raw_values. 下表给出了温度与原始值的快速视图。



10.3.2 Converting motor temperature (T-motor, KTY 84 sensor) 转换电机温度 (T 型电机, KTY 84 传感器)

The temperature of the motor can be read from register [0x49](#) or CANopen object 2049. In the following description, the actual temperature read, is called **Actual_temp_raw**.

电机温度可以从寄存器 0x49 或 CANopen 对象 2049 中读取。在下面的描述中，实际读取的温度称为 Actual_temp_raw。（实际温度原始值）

The following data is needed for the conversion (Temperature is in °C):转换需要以下数据（温度单位为 °C）：

Table 25 Raw motor temperature values (KTY 84)

表 25 原始电机温度值 (KTY 84)

i	Raw_value 原始值	Temperature 温度
1	1063	-60
2	1989	-50
3	2968	-40
4	3993	-30
5	4521	-25
6	5060	-20
7	6164	-10
8	7301	0
9	8467	10
10	9657	20
11	10260	25
12	10868	30
13	12094	40
14	13332	50
15	14579	60
16	15832	70
17	16459	75
18	17086	80
19	18340	90
20	19590	100
31	20834	110
32	22070	120
33	22684	125
34	23295	130
35	24508	140
36	25707	150
37	26891	160
38	28059	170
39	28636	175
40	29209	180

i	Raw_value 原始值	Temperature 温度
41	30340	190
42	31452	200
43	32543	210

10.3.2.1 Conversion from units to C° KTY 84 从单位转换为 C°KTY 84

When converting a temperature given in raw values to centigrade, the interval **i** must be found. Select the first interval (table row) in [Table 25](#) on page [230](#) where the **Raw_value** is smaller than the **Actual_temp_raw**. 将原始值中给出的温度转换为摄氏度时，必须找到区间 **i**。在第 177 页的表 25 中选择原始值小于实际温度原始值的第一个区间（表行）。

Formula:公式

Actual temperature °C 实际摄氏度 =

$$Temperature [i] + \frac{(Actual_temp_raw - Raw_value[i]) * (temperature [i + 1] - temperature[i])}{Raw_value[i + 1] - Raw_value[i]}$$

Example of converting a value of 24000 units to °C:
将 24000 个单位的值转换为 °C 的示例:

$$130 + \frac{(24000 - 23295) * (140 - 130)}{24508 - 23295} = 135.81$$

24000 units ≈ 136 °C

Actual_temp_raw 实际温度原始值 = 24000

i = row 34 is selected 选择第 34 行

Temperature 温度[**i**] = 130

Temperature 温度[**i**+1] = 140

Raw_value 原始值[**i**] = 23295

Raw_value 原始值[**i**+1] = 24508

10.3.2.2 Conversion from C° to units KTY 84 从 C°转换为单位 KTY 84

When converting a temperature given in °C to raw values, the interval **i** must be found. Select the first interval (table row) in [Table 25](#) on page [230](#) where the **Temperature** is smaller than the **Actual temperature °C**. 将以 °C 给出的温度转换为原始值时，必须找到区间 **i**。在第 177 页的表 25 中选择温度小于实际温度 °C 的第一个区间（表行）。

Formula for conversion from °C to raw temperature:从 °C 到原始温度的转换公式:

Actual_temp_raw =

$$Raw_value[i] + \frac{(Actual_temperature\ °C - Temperature [i]) * (Raw_value[i + 1] - Raw_value[i])}{temperature [i + 1] - temperature[i]}$$

Example of converting a value of 135.8 °C to units:
将 135.8 °C 的值转换为单位的示例:

$$23295 + \frac{(135.8 - 130) * (24508 - 23295)}{140 - 130} = 23999.7$$

°C ≈ 24000 units

Actual temperature °C 实际温度°C= 135.8

i = row 34 is selected 选择第 34 行

Temperature 温度[**i**] = 130

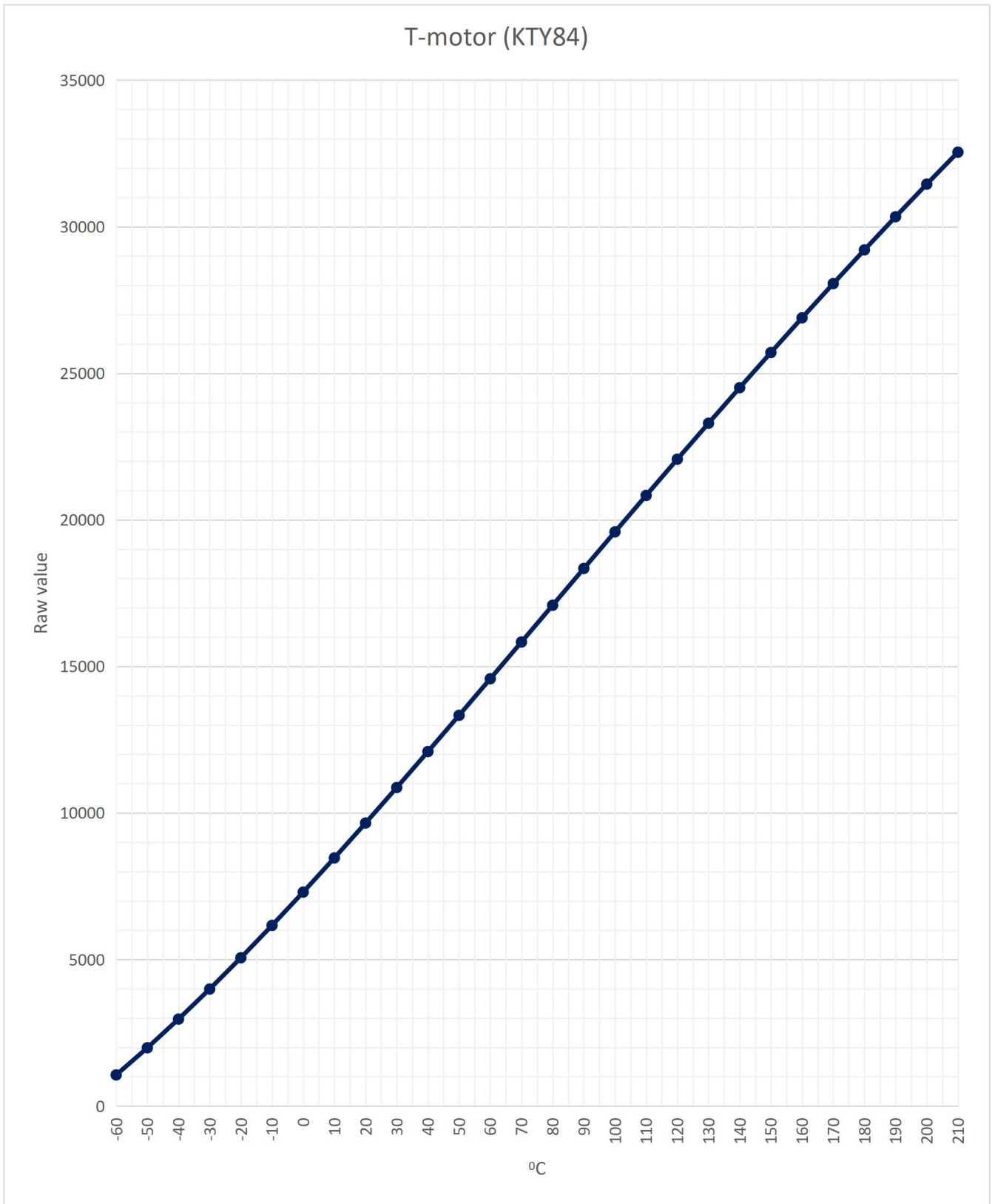
Temperature 温度[**i**+1] = 140

Raw_value 实际值[**i**] = 23295

Raw_value 实际值[**i**+1] = 24508

10.3.2.3 Quick conversion chart 快速转换图

The following chart gives a quick view of temperature vs. raw_values. 下表给出了温度与原始值的快速视图。



10.3.3 Converting motor temperature (T-motor, Pt100 sensor) 转换电机温度 (T 型电机, Pt100 传感器)

The temperature of the motor can be read from register [0x49](#) or CANopen object 2049. In the following description, the actual temperature read, is called **Actual_temp_raw**.

可以从寄存器 0x49 或 CANopen 对象 2049 读取电机温度。在以下描述中，实际温度读数称为 **Actual_temp_raw**。（实际温度原始值）。

The following data is needed for the conversion (Temperature is in °C): 转换需要以下数据（温度单位为 °C）：

Table 26 Raw temperature values T-motor (Pt100)

表 26 T 型电机 (Pt100) 的原始温度值

i	Raw_value 原始值	Temperature 温度
1	455	-60
2	1678	-50
3	2897	-40
4	4112	-30
5	4718	-25
6	5324	-20
7	6531	-10
8	7735	0
9	8935	10
10	10132	20
11	10729	25
12	11325	30
13	12514	40
14	13700	50
15	14883	60
16	16061	70
17	16650	75
18	17237	80
19	18409	90
20	19577	100
31	20741	110
32	21903	120
33	22482	125
34	23060	130

i	Raw_value 原始值	Temperature 温度
35	24214	140
36	25365	150
37	26512	160
38	27655	170
39	28225	175
40	28795	180
41	29931	190
42	31064	200
43	32193	210

10.3.3.1 Conversion from units to C° T-motor Pt100 从单位转换为 C°T 型电机 Pt100

When converting a temperature given in raw values to centigrade, the interval i must be found. Select the first interval (table row) in [Table 26](#) on page [233](#) where the **Raw_value** is smaller than the **Actual_temp_raw**. 将原始值中给定的温度转换为摄氏度时，必须找到区间 i。选择第 180 页表 26 中原始值小于实际温度原始值的第一个区间（表行）。

Formula:公式

Actual temperature °C 实际温度摄氏度 =

$$Temperature [i] + \frac{(Actual_temp_raw - Raw_value[i]) * (temperature [i + 1] - temperature[i])}{Raw_value[i + 1] - Raw_value[i]}$$

Example of converting a value of 24000 units to °C:
将 24000 个单位的值转换为 °C 的示例:

$$130 + \frac{(24000 - 23060) * (140 - 130)}{24214 - 23060} = 138.14$$

24000 units ≈ 138 °C

Actual_temp_raw 实际温度原始值 = 24000

i = row 34 is selected 选择第 34 行

Temperature 温度[i] = 130

Temperature 温度[i+1] = 140

Raw_value 原始值[i] = 23060

Raw_value 原始值[i+1] = 24214

10.3.3.2 Conversion from C° to units Pt100 从 C°转换为单位 Pt100

When converting a temperature given in °C, the interval i must be found. Select the first interval (table row) in [Table 26](#) on page [233](#) where the **Temperature** is smaller than the **Actual temperature °C**.

Formula for conversion from °C to raw temperature:

在转换以 °C 给出的温度时，必须找到区间 i。在第 180 页的表 26 中选择温度小于实际温度 °C 的第一个区间（表行）。

从 °C 到原始温度的转换公式:

Actual_temp_raw 实际温度原始值 =

$$Raw_value[i] + \frac{(Actual\ temperature\ ^\circ C - Temperature\ [i]) * (Raw_value[i + 1] - Raw_value[i])}{temperature\ [i + 1] - temperature[i]}$$

Example of converting a value of 138.1 °C to units:

将 138.1° C 的值转换为单位的示例:

$$23060 + \frac{(138.1 - 130) * (24214 - 23060)}{140 - 130} = 23995$$

138.1 °C ≈ 24000 units

Actual temperature °C 实际温度°C=
138.1

i = row 34 is selected 选择第 34 行

Temperature 温度[i] = 130

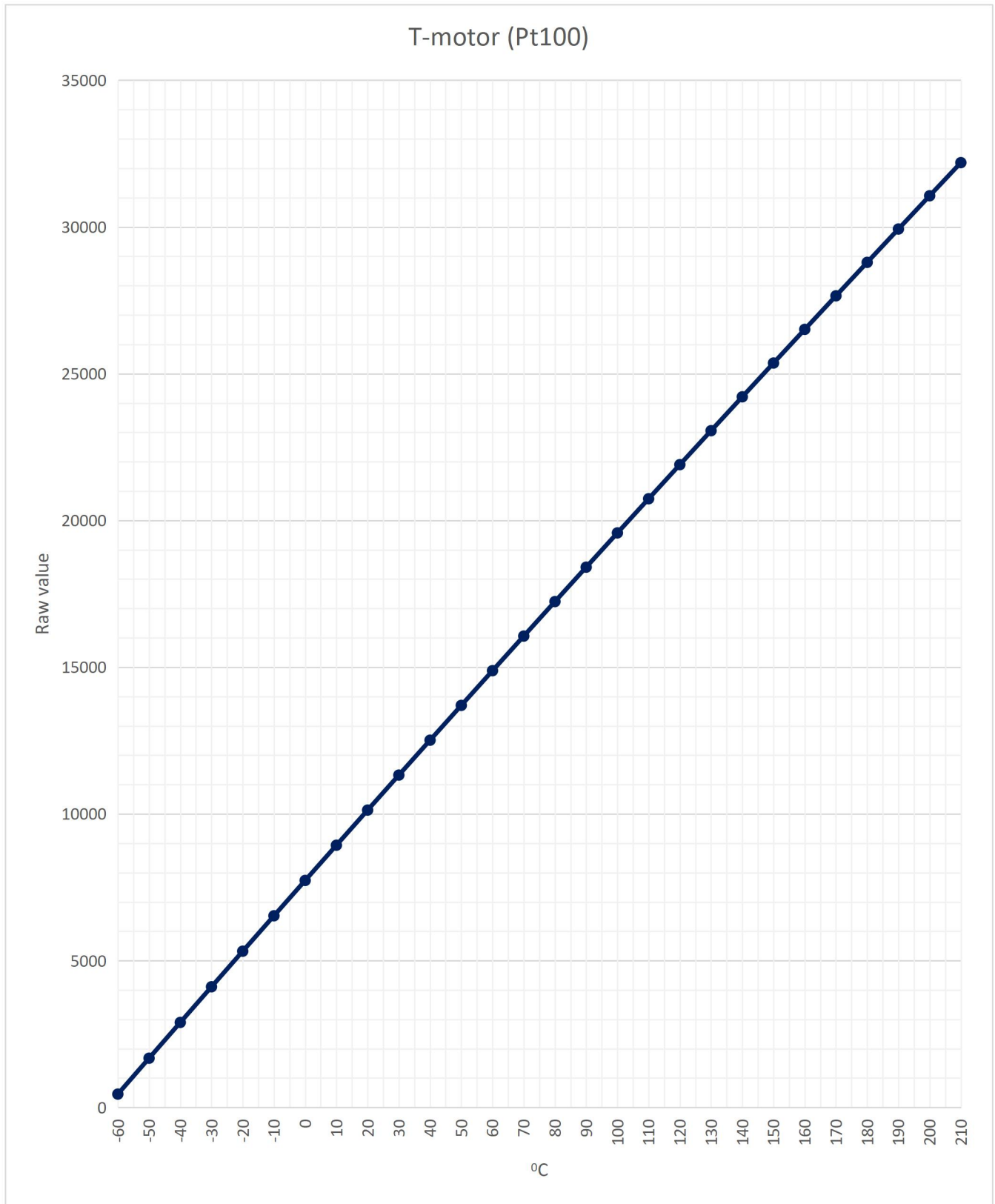
Temperature 温度[i+1] = 140

Raw_value 原始值[i] = 23060

Raw_value 原始值[i+1] = 24214

10.3.3.3 Quick conversion chart 快速转换图

The following chart gives a quick view of temperature vs. raw_values. 下表给出了温度与原始值的快速视图。



10.3.4 Converting temperature Pt100 sensor (Pt1 to Pt4) 转换温度 Pt100 传感器 (Pt1 到 Pt4)

The temperature of a Pt100 sensor temperature in raw values can be read from any of the four Pt100 registers (see [0x9C - 0x9F](#)), or CANopen objects 209C to 209F. In the following description, the actual temperature read, is called **Actual_temp_raw**.

The following data is needed for the conversion (Temperature is in °C):

可以从四个 Pt100 寄存器中的任何一个（参见 0x9C - 0x9F）或 CANopen 对象 209C 到 209F 读取原始值中的 Pt100 传感器温度。在以下描述中，实际读取的温度称为 Actual_temp_raw。（实际温度原始值）

转换需要以下数据（温度单位为 °C）：

Table 27 Raw temperature values Pt100

表 27 原始温度值 Pt100

i	Raw_value 原始值	Temperature 温度
1	57	-60
2	210	-50
3	362	-40
4	514	-30
5	590	-25
6	665	-20
7	816	-10
8	967	0
9	1117	10
10	1266	20
11	1341	25
12	1416	30
13	1564	40
14	1712	50
15	1860	60
16	2008	70
17	2081	75
18	2155	80
19	2301	90
20	2447	100
31	2593	110
32	2738	120
33	2810	125

i	Raw_value 原始值	Temperature 温度
34	2882	130
35	3027	140
36	3171	150
37	3314	160
38	3457	170
39	3528	175
40	3599	180
41	3741	190
42	3883	200
43	4024	210

10.3.4.1 Conversion from units to C° Pt100 (Pt1-Pt4)从单位转换为 C°Pt100 (Pt1-Pt4)

When converting a temperature given in raw values to centigrade, the interval **i** must be found. Select the first interval (table row) in [Table 27](#) on page [237](#) where the **Raw_value** is smaller than the **Actual_temp_raw**. 将原始值中给出的温度转换为摄氏度时，必须找到区间 **i**。选择第 183 页的表 27 中原始值小于实际温度原始值的第一个区间（表行）

Formula:公式

Actual temperature °C 实际温度摄氏度 =

$$Temperature [i] + \frac{(Actual_temp_raw - Raw_value[i]) * (temperature [i + 1] - temperature[i])}{Raw_value[i + 1] - Raw_value[i]}$$

Example of converting a value of 3000 units to °C:

将 3000 个单位的值转换为°C 的示例:

$$130 + \frac{(3000 - 2882) * (140 - 130)}{3027 - 2882} = 138.14$$

3000 units ≈ 138 °C

Actual_temp_raw 实际温度原始值= 3000

i = row 34 is selected 选择第 34 行

Temperature 温度[i] = 130

Temperature 温度[i+1] = 140

Raw_value 原始值[i] = 2882

Raw_value 原始值[i+1] = 3027

10.3.4.2 Conversion from C° to units Pt100 (Pt1-Pt4)从 C°转换为单位 Pt100 (Pt1-Pt4)

When converting a temperature given in °C to raw values, the interval **i** must be found. Select the first interval (table row) in [Table 26](#) on page [233](#) where the **Temperature** is smaller than the **Actual temperature °C**.

Formula for conversion from °C to raw temperature:

将以°C 给出的温度转换为原始值时，必须找到区间 **i**。在第 180 页的表 26 中选择第一个区间（表行），其中温度小于实际温度°C。

从°C 到原始温度的转换公式:

Actual_temp_raw 实际温度原始值 =

$$Raw_value[i] + \frac{(Actual\ temperature\ ^\circ C - Temperature\ [i]) * (Raw_value[i + 1] - Raw_value[i])}{temperature\ [i + 1] - temperature[i]}$$

Example of converting a value of 138.1 °C to units:

将 138.1 °C 的值转换为单位的示例:

$$2882 + \frac{(138.1 - 130) * (3027 - 2882)}{140 - 130} = 2999.5$$

138.1 °C ≈ 3000 units

Actual temperature °C 实际温度° C =

138.1

i = row 34 is selected 选择 34 行

Temperature 温度[i] = 130

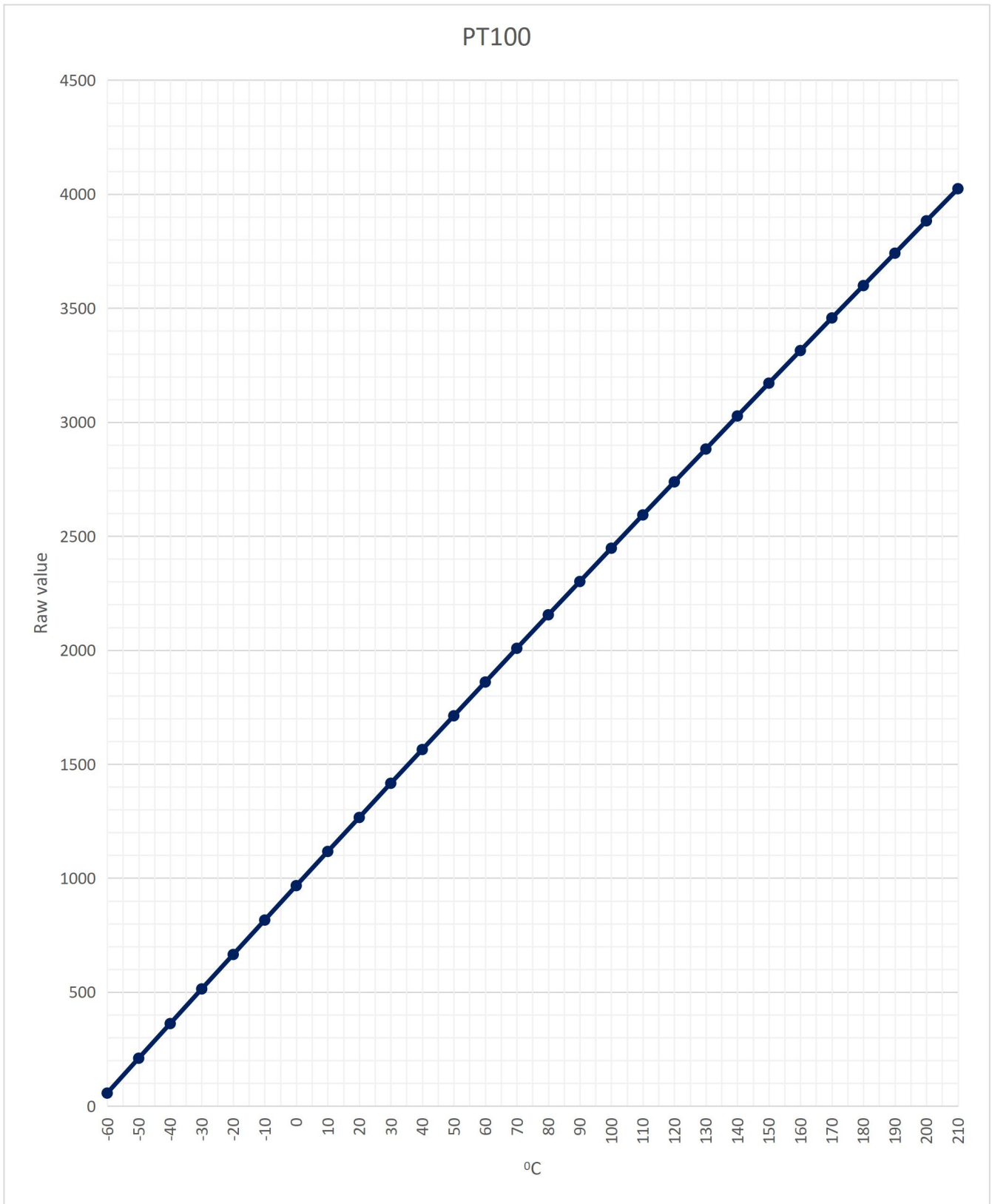
Temperature 温度[i+1] = 140

Raw_value 原始值[i] = 2882

Raw_value 原始值[i+1] = 3027

10.3.4.3 Quick conversion chart 快速转换图

The following chart gives a quick view of temperature vs. raw_values. 下表给出了温度与原始值的快速视图。



10.3.5 Converting (internal) air temperature (T-air)转换 (内部) 空气温度 (T-air)

This section describes how to convert raw values from a KTY 82 air temperature sensor to °C. The temperature in raw values can be read from register [0x4B](#).

In the following description, the actual temperature read in units is called **Actual_temp_raw**.

The following data is needed for the conversion (Temperature is in °C):

本节介绍如何将 KTY 82 空气温度传感器的原始值转换为 °C。可以从寄存器 0x4B 读取原始值中的温度。

在以下描述中，以单位读取的实际温度称为 Actual_temp_raw（实际温度）。

转换需要以下数据（温度单位为 °C）：

Table 28 Raw air temperature values (KTY 82)

表 28 原始空气温度值 (KTY 82)

i	Raw_value 原始值	Temperature 温度
1	7208	-60
2	7734	-50
3	8268	-40
4	8806	-30
5	9075	-25
6	9344	-20
7	9879	-10
8	10409	0
9	10931	10
10	11442	20
11	11694	25
12	11942	30
13	12430	40
14	12904	50
15	13363	60
16	13807	70
17	14024	75
18	14237	80
19	14655	90
20	15049	100
31	15429	110
32	15773	120
33	15927	125
34	16067	130

i	Raw_value 原始值	Temperature 温度
35	16298	140
36	16457	150

When converting a temperature given in raw values to centigrade, the interval **i** must be found. Select the first interval (table row) where the **Raw_value** is smaller than the **Actual_temp_raw**.

将原始值中给出的温度转换为摄氏度时，必须找到区间 **i**。选择原始值小于实际温度原始值的第一个区间（表行）。

Formula:公式

Actual temperature °C 实际温度摄氏度 =

$$Temperature [i] + \frac{(Actual_temp_raw - Raw_value[i]) * (temperature [i+1] - temperature [i])}{Raw_value[i+1] - Raw_value[i]}$$

Example of converting a value of 13000 units to °C:

将 13000 单位的值转换为 °C 的示例:

$$130 + \frac{(13000 - 12904) * (60 - 50)}{13363 - 12904} = 52.01$$

24000 units ≈ 52 °C

Actual_temp_raw 实际温度原始值 = 13000

i = row 14 is selected 选择第 14 行

Temperature 温度[**i**] = 50

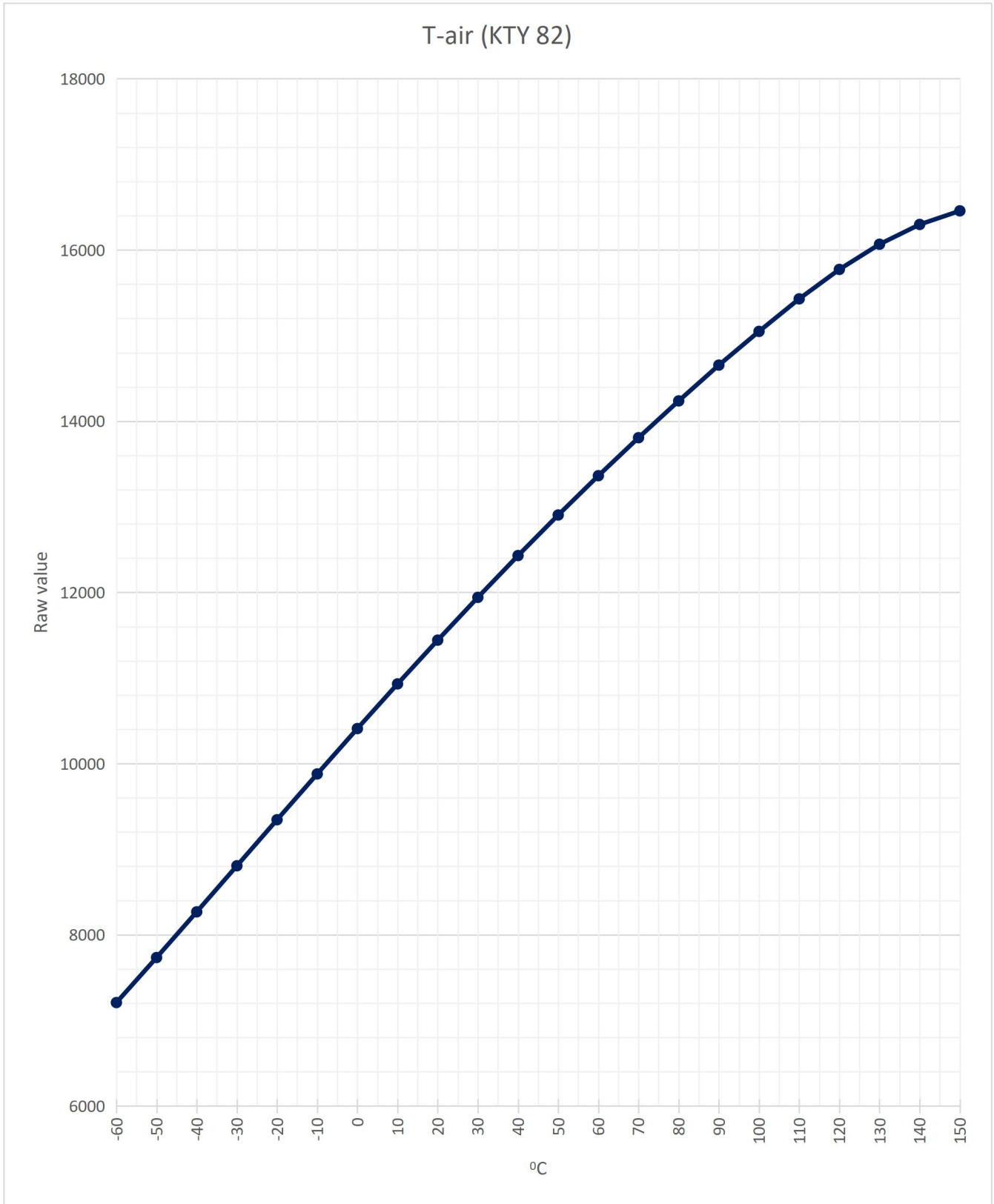
Temperature 温度[**i+1**] = 60

Raw_value 原始值[**i**] = 12904

Raw_value 原始值[**i+1**] = 13363

10.3.5.1 Quick conversion chart 快速转换图

The following chart gives a quick view of temperature vs. raw_values. 下表给出了温度与原始值的快速视图。



10.4 Converting current values 转换电流值

All current measurements unscaled values. In order to convert current measurements to Ampere it is necessary to scale the values by using the following register values:

所有电流测量值均为非标度值。为了将电流测量值转换为安培值，有必要使用以下寄存器值进行缩放值：

- I device (reg. 0xC6, value in 0.1 A). This value is used in internal calculations in the IMD.
I device (reg.0xC6, 数值为 0.1 A)。该值用于 IMD 的内部计算。
- Current 200 pct. (reg. 0xD9). This value is a scaled in raw values and used in internal calculations in the IMD.
电流 200 pct (reg. 0xD9)。该值是原始值的缩放值，用于 IMD 的内部计算。

10.4.1 Converting current raw values to Ampere 将电流原始值转换为安培

To convert any current reading from the IMD, such as CurrentActual (0x20), CurrentAllowedMax (0x24) and so on, use the following formula (the actual current reading is named ActualReading):

要转换来自 IMD 的任何电流读数，例如 CurrentActual (0x20)、CurrentAllowedMax (0x24) 等，请使用以下公式（实际电流读数称为 ActualReading）：

$$Current\ A\ RMS = \frac{I\ Device * ActualReading * 2}{Current\ 200pct * 10}$$

Example of converting a reading from the IMD of 300:
从 IMD 300 转换读数的示例：

$$\frac{600 * 300 * 2}{1287 * 10} = 27.97$$

300 units \approx 28 A_{RMS}

ActualReading 实际电流读数 = 300
I Device (0xC6) = 600
Current 200pct (0xD9) = 1287



Info

It is recommended to read the I device and Current 200 pct at start up and use these values in the conversion.

信息

建议在启动时读取 I device 和电流 200 pct，并在转换中使用这些值。

10.4.2 Converting Ampere to current raw values 将安培转换为电流原始值

To convert any current value in Ampere to its representation in raw values use the following formula (the actual current reading is named “Current A RMS”): 要将任何电流值（安培）转换为其原始值，请使用以下公式（实际电流读数命名为“电流 A RMS”）：

$$Current\ units = \frac{Current\ A\ RMS * Current\ 200pct * 10}{Device\ design\ current * 2}$$

Example of converting a current value of 30:
转换电流值为 30 的示例：

Current A RMS = 30
I Device (0xC6) = 600
Current 200pct (0xD9) = 1287

$$\frac{30 * 1287 * 10}{600 * 2} = 321.75$$

$$30 A_{RMS} \approx 322 \text{ units}$$



Info

It is recommended to read the I device and Current 200 pct at start up and use these values in the conversion.

信息

建议在启动时读取 I device 和电流 200 pct 并在转换中使用这些值。

10.5 Converting speed values 转换速度值

The actual or setpoint for speed stored in the different registers (0x30, 0x31, 0x32, 0x5D, 0xA8) is in numerical values. 0x31 is setpoint for speed. All other mentioned registers contain actual speed as represented in various places in the speed regulation loop. The actual motor speed is stored in 0x30 (N actual) and 0xA8 (N actual (filtered)).

存储在不同寄存器（0x30、0x31、0x32、0x5D、0xA8）中的实际或设定点速度以数值表示。0x31 是速度的设定点。所有其他提到的寄存器包含实际速度，如速度调节回路中不同位置所示。实际电机转速存储在 0x30（N 实际值）和 0xA8（N 实际值（筛选值））中。

10.5.1 Converting speed values from raw values to RPM 将速度值从原始值转换为 RPM

To convert any speed value in raw values to RPM use the following formula: 要将原始值中的任何速度值转换为 RPM，请使用以下公式：

$$RPM = \frac{Speed_value * Nmax_100\%}{32767}$$

RPM: Motor speed in RPM

以 RPM 为单位的电机转速

Nmax_100%: Maximum speed in RPM (0xC8)

以 RPM 为单位的最大转速（0xC8）

Speed_value: Raw value representation of a speed 速度的原始值表示

Example of converting a speed value of 20000 units: 转换速度值为 20000 单位的示例:

$$\frac{20000 * 3000}{32767} = 1831.1$$

$$20000 \text{ Speed_value} \approx 1831 \text{ RPM}$$

Nmax_100% = 3000

Speed_value = 20000

10.5.2 Converting speed values from RPM to raw values 将转速值从 RPM 转换为原始值

To convert any speed value in units to RPM use the following formula:

要将任何单位的速度值转换为 RPM，请使用以下公式：

$Speed_values = \frac{RPM * 32767}{Nmax_100\%}$	<p>RPM: Motor speed in RPM 以 RPM 为单位的电机转速</p> <p>Nmax_100%: Maximum speed in RPM (0xC8) 以 RPM 为单位的最大转速 (0xC8)</p> <p>Speed_value: Raw value representation of a speed 速度的原始值表示</p>
<p>Example of converting a speed value of 2000 RPM:转换速度值为 2000 RPM 的示例:</p> $\frac{2000 * 32767}{3000} = 21844.7$ <p>2000 RPM ≈ 21845 Speed_value</p>	<p>Nmax_100% = 3000</p> <p>RPM = 2000</p>

10.6 Converting torque values 转换扭矩值

Torque raw values are used in registers 0x90 (Torque set-point) and 0xA0 (torque actual). To convert the raw values to Nm and vice versa, the specific torque constant of the actual motor (from the data sheet) is used. Note that this constant changes with the speed. If a very accurate result is desired, this must be taken into account.

In order to scale the current measurement, I device (reg. 0xC6, value in 0.1 A) need to be used.

扭矩原始值用于寄存器 0x90（扭矩设定点）和 0xA0（扭矩实际值）。要将原始值转换为 Nm，反之亦然，需要使用实际电机的特定扭矩常数（来自数据表）。请注意，该常数随速度而变化。如果需要非常准确的结果，则必须考虑到这一点。

为了缩放电流测量值，需要使用 I device（reg. 0xC6，值为 0.1 A）。

10.6.1 Converting torque raw values to Nm 将扭矩原始值转换为 Nm

To convert any torque value in raw values to Nm use the following formula:要将原始值中的任何扭矩值转换为 Nm，请使用以下公式：

$Nm = \frac{Torque_{raw_value} * I Device * Df * K_T}{32767}$	<p>Nm: Motor torque in Newton metre 电机扭矩，单位为牛顿米</p> <p>K_T: Specific torque constant of the actual motor 实际电机的特定扭矩常数</p> <p>Df: Device factor, depending on the IMD type, I extended bit, and Peak plus option:设备因数，取决于 IMD 类型、I 扩展位和 Peak +选项:</p>																
	<table border="1"> <thead> <tr> <th>Type 类型</th> <th>Peak plus 峰值加</th> <th>I extended I 扩展</th> <th>Df</th> </tr> </thead> <tbody> <tr> <td>IMD 122 B/C</td> <td style="text-align: center;">✘</td> <td style="text-align: center;">✘</td> <td>1.5</td> </tr> <tr> <td>IMD 122 B/C</td> <td style="text-align: center;">✘</td> <td style="text-align: center;">✔</td> <td>1.725</td> </tr> <tr> <td>IMD 122 C</td> <td style="text-align: center;">✔</td> <td style="text-align: center;">N/A</td> <td>2.25</td> </tr> </tbody> </table>	Type 类型	Peak plus 峰值加	I extended I 扩展	Df	IMD 122 B/C	✘	✘	1.5	IMD 122 B/C	✘	✔	1.725	IMD 122 C	✔	N/A	2.25
Type 类型	Peak plus 峰值加	I extended I 扩展	Df														
IMD 122 B/C	✘	✘	1.5														
IMD 122 B/C	✘	✔	1.725														
IMD 122 C	✔	N/A	2.25														

	IMD 135 C	✘	✘	2.6
	IMD 135 C	✘	✔	3
	IMD 135 C	✔	N/A	4

Example of converting a torque value of 2000 units: 转换扭矩值为 2000 单位的示例:

$$\frac{2000 * 60 * 1.5 * 2.66}{32767} = 14.61$$

2000 Torque_{raw_value} ≈ 14.6 Nm

I Device (0xC6) / 10 = 600/10 = 60
K_T = 2.66
Df = 1.5
Torque_{value} = 2000

10.6.2 Converting Torque Nm to raw values 将扭矩 Nm 转换为原始值

To convert any torque value in raw values to Nm use the following formula:

要将原始值中的任何扭矩值转换为 Nm，请使用以下公式：

$Torque_{raw_value} = \frac{Torque_{Nm} * 32767}{I Device * 1.5 * K_T}$	<p>Nm: Motor torque in Newton metre 电机扭矩，单位为牛顿米</p> <p>K_T: Specific torque constant of the actual motor 实际电机的特定扭矩常数</p> <p>Df: The same as in previous section 与上一节相同</p>
<p>Example of converting a torque value of 14 Nm: 转换扭矩值为 14 Nm 的示例:</p> $\frac{14 * 32767}{60 * 1.5 * 2.66} = 1916.2$ <p>14 Torque_{Nm} ≈ 1916 Torque_{raw_value}</p>	<p>I Device (0xC6) / 10 = 600/10 = 60 K_T = 2.66 Df = 1.5 Torque_{Nm} = 14</p>

11. Protection and errors description 保护和错误描述

11.1 Voltage protection and errors 电压保护和错误

There are two DC-link voltage error mechanisms: 有两种直流母线电压错误机制:

1. “HW” mechanism (the trigger for the error is a HW signal but the protection and error are executed by the SW) “硬件”机制（错误触发是一个硬件信号，但保护和错误由软件执行）
2. SW mechanism 软件机制

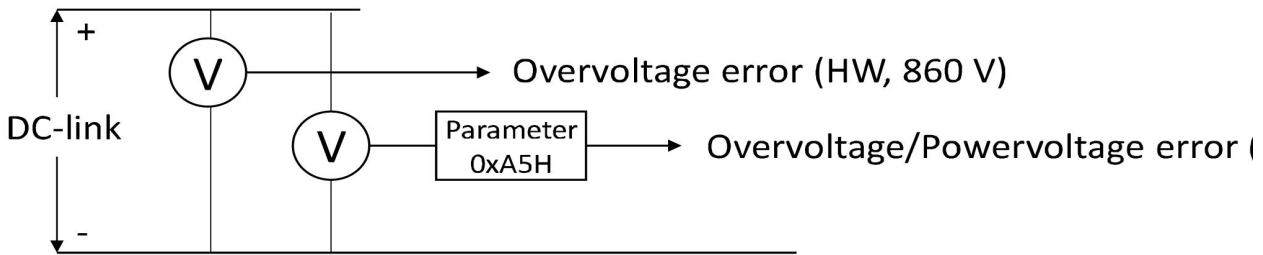


Figure 44 Voltage error and protection mechanisms

图 44 电压错误和保护机制

11.1.1 Overvoltage error 超压错误

The overvoltage error can be generated by both SW and HW mechanisms.

The SW mechanism measures the DC-link voltage and triggers the error at the DC-link V_{max} threshold (Reg. 0xA5 H, default 789 V).

The HW mechanism generates an error signal when the DC-link voltage exceeds 860 V DC.

Both mechanisms result in error 8 (OVERVOLTAGE), after which the drive is immediately disabled.

软件和硬件机制都可以产生超压误差。

软件机制测量直流母线电压并在直流母线最大值阈值（寄存器 0xA5 H，默认为 789 V）处触发错误。

当直流母线电压超过 860 V DC 时，硬件机制会生成错误信号。

这两种机制都会导致错误 8 (OVERVOLTAGE)，之后驱动器立即被禁用。

11.1.2 Under voltage error 欠压错误

This error is generated only by the SW mechanism. The threshold for this error is set by the DC-link V_{min} parameter (Reg. 0xA5 L). The error generated when the DC-link voltage is below DC-link V_{min} is error 5 (UNDERVOLTAGE), after which the drive is immediately disabled.

此错误仅由 SW 机制生成。此错误的阈值由直流母线 V_{min} 参数（注册 0xA5 L）设置。直流母线电压低于直流母线 V_{min} 时产生的错误为错误 5（欠压），之后驱动器立即被禁用。

12.Errors and warnings 错误和警告

The IMD has two ways to report faults: Errors and warnings:

IMD 有两种报告故障的方式： 错误和警告：

	Cause and action 原因和行动	Reset 重置
Warning 警告	<p>Normal parameter limits are beginning to be crossed. No immediate action.</p> <p>If not addressed, some warnings might escalate to errors after a timeout.</p> <p>开始超过正常的参数限制。不立即采取行动。</p> <p>如果不解决，一些警告可能会在超时后升级为错误。</p>	<p>Automatically reset when the cause is removed.</p> <p>排除原因后自动重置。</p>
Error 错误	<p>Severe violation of limits, causing a safety chain trip, and either an immediate motor stop or initiating a safety run.</p> <p>严重违反限制，导致安全链跳闸，并立即停止电机或启动安全运行。</p>	<p>Reset is done either from the controller, another USB device, or using the IMD Manager tool.</p> <p>From the application SW or another USB device, writing any value to register 0x8E resets errors.</p> <p>Reset is not possible if the cause is not removed.</p> <p>可以从控制器、另一个 USB 设备或使用 IMD 监控软件工具完成重置。</p> <p>从应用软件或其他 USB 设备写入任何值到寄存器 0x8E 将重置错误。</p> <p>如果原因未消除，则无法重置。</p>

Both errors and warnings are displayed on the IMD display and the IMD Manager tool.

错误和警告都显示在 IMD 显示屏和 IMD 监控软件工具上。

12.1 Error list 错误列表

When an error is active it is displayed in the IMD Manager tool in the “Error(s)” field. Following is a list of errors: 当错误激活时，它将显示在 IMD 监控软件工具的“错误”字段中。以下是错误列表：

Table 29 Error list and description

表 29 错误列表和说明

IMD display / Error bit no.IMD 显示/错误位号。	IMD Manager Error(s) field IMD 监控软件错误显示字段	Safety run performed 执行安全运行	Error description 错误描述
0	BADPARAS	No 否	Checksum (CRC) error when reading parameters from EEPROM. This error can only be reset by a

IMD display / Error bit no. IMD 显示/错误位号。	IMD Manager Error(s) field IMD 监控软件错误显示字段	Safety run performed 执行安全运行	Error description 错误描述
	参数错误		power-cycle (OFF-ON) of the IMD. 从 EEPROM 读取参数时出现校验和 (CRC) 错误。此错误只能通过 IMD 的电源循环 (关闭-开启) 重置。
1	POWER FAULT 电源失效	No 否	A fault condition related to the IGBT module is detected. 检测到与 IGBT 模块相关的故障。
2	RFE open RFE 开	No 否	RFE (Rotational Field Enable) input is in low state. RFE-关闭。RFE (旋转场启用) 输入处于低状态。
3	BUS TIMEOUT 总线超时	Yes 是	<p>This error can be caused by three reasons:此错误可能由以下三个原因引起:</p> <ul style="list-style-type: none"> Timeout has occurred on the CAN-bus. Timeout period defined in ms in register CAN_TIMEOUT (0xd0). The bus time out error is enabled after the CAN bus has reached operational state. CAN 总线发生超时。在寄存器 CAN_TIMEOUT (0xd0) 中以毫秒为单位定义的超时周期。总线超时错误在 CAN 总线达到运行状态后启用。 Communication error with the built-in charger (after the communication was initialised at start-up).与内置充电器的通信错误 (启动时通信初始化后)。 Communication error with the built-in charger (option). When resulting from this reason, the error is generated automatically after warning 3 has been active during the Charger timeout period and not cleared. 与内置充电器 (选装件) 的通信错误。由于此原因, 在充电器超时期间警告 3 激活且未清除后, 会自动生成错误。
4	FEEDBACK 反馈	Yes 是	Bad or no motor feedback signal. The resolver circuit detects a fault. 电机反馈信号不良或无信号。编码器电路检测到故障。
5	UNDERVOLTAGE 欠压	No 否	DC link voltage is lower than DC-link Vlow or DC-link Vmin. 直流母线电压低于直流母线 Vlow 或直流母线 Vmin。
6	MOTORTEMP	Yes 是	Motor temperature too high. Motor-temperature reached the limit specified in <i>M-temp</i> .

IMD display / Error bit no. IMD 显示/错误位号。	IMD Manager Error(s) field IMD 监控软件错误显示字段	Safety run performed 执行安全运行	Error description 错误描述
			<p>This error can be reset after the motor had cooled down. 电机温度过高。电机温度达到 M-temp 中规定的极限。 此错误可在电机冷却后重置。</p>
7	DEVICETEMP 设备温度	Yes 是	<p>IMD temperature too high. This error can be reset after the IMD had cooled down. IMD 温度过高。 此错误可在 IMD 冷却后重置。</p>
8	OVERVOLTAGE 超压	Yes/No 是/否	<p>DC-link voltage upper limits (HW DC-link overvoltage or DC-link Vmax) exceeded. 超出直流母线电压上限 (HW 直流母线超压或直流母线 Vmax)。</p>
9	I_PEAK 峰值电流	No 否	<p>The current to the motor exceeded the peak current limit for more than 8 ms. 电机电流超过峰值电流限制超过 8 毫秒。</p>
A	MOTOR OUTPUT 电机输出	No 否	<p>The motor speed and direction cannot be controlled. The motor either races at full speed or cannot move. This error can be caused by four reasons: 无法控制电机速度和方向。电机要么全速运转，要么无法移动。此错误可能由四个原因引起：</p> <ul style="list-style-type: none"> • Non coherent parameter configuration. 非相干参数配置。 • Mismatch between the direction from the drive and direction from the motor feedback. 驱动方向与电机反馈方向不匹配。 • The phase sequence (W, V, U) is wrong. 相序 (W、V、U) 错误。 • At least one of the phases from the IMD to the motor is disconnected. 从 IMD 到电机至少有一个相位断开。
B	CHARGER 充电		<p>Error in the charger (option). This error is generated automatically after warning B has been active during the Charger timeout period and not cleared. There are a number of charger errors that caused the warning that was escalated to the error. Possible errors are listed in section 12.1.1 on page 253. The active errors can be determined by reading the</p>

IMD display / Error bit no. IMD 显示/错误位号。	IMD Manager Error(s) field IMD 监控软件错误显示字段	Safety run performed 执行安全运行	Error description 错误描述
			<p>charger error register. 充电器错误（选装件）。在充电超时期间警告 B 已激活且未清除后，会自动生成此错误。</p> <p>有许多充电器错误导致警告升级为错误。第 193 页第 12.1.1 节列出了可能的错误。可通过读取充电错误寄存器来确定激活的错误。</p>
C	HIGHVOLTAGE 高压	Yes 是	<p>HIGHVOLTAGE warning was on more than approximately five seconds. 高压警报持续了大约 5 秒。</p>
D	PRE_CHARGE 预充电	Yes 是	<p>Pre-charge circuit failure. Mains power cannot be connected to DC link. 预充电电路故障。主电源不能连接到直流母线。</p>
E	HW-ERROR 硬件错误	No 否	<p>Hardware component failure. Multiple reasons can cause this error. For example: 硬件组件故障。多个原因可能导致此错误。例如：</p> <ul style="list-style-type: none"> • An internal supply voltage has failed 内部电源电压出现故障 • Internal communication to power-module has timed out 与电源模块的内部通信已超时 • The controller has detected a power-module error-condition 控制器检测到电源模块故障 • The internal current measurement has failed 内部电流测量失败 <p>Determination of the precise reason can only be done by experts, possibly also using the errors log. 准确的原因只能由专家来确定，也可能使用错误日志。</p>
F	BALLAST 镇流器	Yes 是	<p>This error can be caused by two reasons: 此错误可能由两个原因引起：</p> <ul style="list-style-type: none"> • Ballast resistor overload. The ballast resistor load has exceeded the configured value (Ballast-P). This error can be reset after a timeout has elapsed. 制动电阻过载。制动电阻负载已超过配置值（镇流器-P）。超时后，可以重置此错误。 • Hardware failure in the ballast circuit or resistor 镇流器电路或电阻器中的硬件故障

12.1.1 Charger (option) errors 充电器（可选件）错误

If the built-in charger option is mounted in the IMD, the following errors can be read from the charger warnings register: 如果内置充电器选件安装在 IMD 中，则可以从充电器警告寄存器中读取以下错误：

Error bit no. 错误位号	Error text 错误文本	Error description 错误描述
0	OPENCIRCUIT 断路	The charger detected open circuit. No safe energy source is connected, or a wire is broken. 充电器检测到断路。没有连接后备电源，或者电线断了。
1	SHORTCIRCUIT 短路	The SE output is short-circuited. SE 输出短路。 For lead acid this error is raised when the SE voltage is less than 20% of nominal while charging. 对于铅酸，当充电时 SE 电压低于标称值的 20% 时，会出现此错误。
2	CHARGERTEMP 充电器温度	The internal temperature of the charger is too high. 充电器内部温度过高。

12.2 Warning list 警告列表

When a warning is active it is displayed in the IMD Manager tool in the “Warning(s)” field. Following is a list of warnings: 当警告处于激活状态时，它会在 IMD 监控软件工具的“警告 (s)” 字段中显示。

Table 30 Warning list and description

表 30 警告列表和说明

Warning bit no. 警告位号	IMD Manager Warning(s) field IMD 监控软件警告字段	Warning description 警告描述
0	BADPARA 参数错误	Parameter error. This warning can be caused by the following reasons: 参数错误。此警告可能由以下原因引起： <ul style="list-style-type: none"> Deceleration ramp too long when “Run” signal is deactivated 当“运行”信号停用时，减速坡道过长 Calculation of motor-parameters gives an unlikely result 电机参数的计算给出了一个不太可能的结果
1	Warning 警告 1	Not used 未使用
2	Warning 警告 2	Not used 未使用
3	COMCHARGER 充电器通信	Communication error with the built-in charger (option). If this warning persists for the Charger timeout period, and the IMD is configured to escalate charger warnings to error, error 3 will be generated. Sending “clear errors” every 8 seconds will delay error

Warning bit no. 警告位号	IMD Manager Warning(s) field IMD 监控软件警告字段	Warning description 警告描述
		<p>generation (until clearing errors is stopped) if the warning persists.</p> <p>与内置充电器（选件）的通信错误。</p> <p>如果此警告在充电器超时时间内持续存在，并且 IMD 被配置为将充电器警告升级为错误，则将生成错误 3。</p> <p>如果警告持续存在，每 8 秒发送一次“清除错误”将延迟错误生成（直到清除错误停止为止）。</p>
4	FEEDBACK 反馈	<p>Unstable resolver signal. This warning is also active during blind safety run.编码器信号不稳定。此警告在盲安全运行期间也被激活。</p>
5	POWERTVOLTAGE 电源电压	<p>Safe energy voltage is lower than SE Vmin. 后备电源电压低于 SE Vmin</p>
6	MOTORTEMP 电机温度	<p>--Motor temperature high. Motor-temperature reached 87.5% of the limit specified in M-temp. 电机温度高。电机温度达到 M-temp 中规定限值的 87.5%。</p>
7	DEVICETEMP 设备温度	<p>IMD temperature high. Internal components temperature exceeded 72 °C. IMD 温度高。 内部部件温度超过 72° C。</p>
8	Warning 警告	<p>Not used 未使用</p>
9	I_PEAK 电流峰值	<p>Digital output driver is overheated 数字输出驱动器过热</p>
A	Warning 警告 A	<p>Not used 未使用</p>
B	CHARGER 充电器	<p>Error in the charger (option). There are a number of charger errors that caused the warning that was escalated to the error. These can be determined by reading the charger error register. If this warning persists for the Charger timeout period, and the IMD is configured to escalate charger warnings to error, error 3 will be generated. Sending “clear errors” every 8 seconds will delay error generation (until clearing errors is stopped) if the warning persists. 充电器错误(选件)。 有许多充电器错误导致警告升级为错误。这些可以通过读取充电器错误寄存器来确定。 如果此警告在充电器超时时间内持续存在，并且 IMD 配置为将充电器警告升级为错误，则会生成错误 3。 如果警告持续存在，每 8 秒发送一次“清除错误”将延迟错误生成（直到清除错误停止为止）。</p>

Warning bit no. 警告位号	IMD Manager Warning(s) field IMD 监控软件警告字段	Warning description 警告描述
C	HIGHVOLTAGE 高压	Ballast resistor is on too long (> 100 ms) while the Mains is ON. If the pitch controller does not act for more than 5 seconds, a HIGHVOLTAGE error is generated, and the warning is reset. 主电源接通时制动电阻接通时间过长 (>100 ms)。如果变桨控制器未动作超过 5 秒，将产生高压错误，并重置警告。
D	Warning 警告 D	Not used 未使用
E	HW-warning 硬件警告	This warning can be caused by the following reasons:此警告可能由以下原因引起： <ul style="list-style-type: none"> • Current offset too high (too far from zero) 电流偏移量太高（离零太远） • Pt100 measurements are wrong, measured value cannot be trusted Pt100 测量错误，测量值不可信 • DI 10, 11 or 12 is high when not in manual operation mode (and manual mode is enabled). DI 10、11 或 12 在不处于手动操作模式（且手动模式已启用）时为高。
F	BALLAST 镇流器	The ballast resistor load is over 50% the configured maximum value. 制动电阻负载超过配置最大值的 50%。

12.2.1 Charger (option) warnings 充电器（选件）警告

If the built-in charger option is mounted in the IMD, the following warnings can be read from the charger warnings register:如果内置充电器选件安装在 IMD 中，则可以从充电器警告寄存器中读取以下警告：

Warning bit no. 警告位号	Warning text 警告文本	Description 描述
0	BATTEMP 电池温度	The battery temperature is more than 10°C outside charging temperature limits (-20°C to 50°C). Lead acid only. 电池温度超出充电温度限制（-20°C 至 50°C）10°C 以上。仅铅酸。
1	TEMPCHANNEL 温度通道	The defined temperature sensor channel is not valid. 定义的温度传感器通道无效。
2	VinLOW	The input voltage from the DC-link is below 270 V DC. 直流母线的输入电压低于 270 V DC。
3	Vin-VseLOW	The input voltage from the DC-link is not at least 15 V DC higher than the SE voltage.

Warning bit no. 警告位号	Warning text 警告文本	Description 描述
		直流母线的输入电压至少不比 SE 电压高 15 V DC。
4	LOWCURR.	The output current is too low compared to setpoint. 与设定值相比，输出电流过低。

12.3 Error log 错误日志

The IMD has an error log containing up to 20 entries. The log is a rolling log using “First In First Out” principle, which means that it always contain the latest 20 errors generated by the IMD, with the latest error at the top. The log entries are available in the IMD Manager and through CAN/CANopen. Each entry contains the following parameter values at the time the error occurred (see description of the register in the Integration manual for details):

IMD 中有一个包含最多 20 个条目的错误日志。日志是使用“先入先出”原则的滚动日志，这意味着它总是包含 IMD 生成的最新 20 个错误，且最新的错误在顶部。这些日志条目可在 IMD 管理器或通过 CAN/CANOpen 获得。每个条目都包含错误发生时的以下参数值（详情请参阅集成手册中的寄存器说明）：

Information 信息	Register 寄存器	Description 描述
IMD state	0x02	The state of the IMD IMD 状态
T-IGBT	0x4A	The numeric representation of the IGBT temperature IGBT 温度的数值表示法
N act (filt)	0xA8	The filtered actual speed value in units 过滤后的单位实际速度
N cmd ramp	0x32	Speed command after ramp in units 以坡道为单位的速度命令
I act (filt)	0x5F	Actual filtered current value in units 实际被过滤后的单位电流
DC-link voltage	0xEB	The filtered voltage of the DC-link in units 直流母线的单位过滤电压
Drive status	0x40	Bit map representation of the state of the internal flags 内部标志状态的位图显示
Logic in block	0x9B	Bit map representation of the state of digital inputs and some internal flags 数字输入状态和一些内部标志的位图显示
Out block	0x98	Bit map representation of the state of digital outputs

Information 信息	Register 寄存器	Description 描述
		数字输出状态的位图显示
Power board status	0x63	Status of the power board 电源板的状态
Actual current limit	0x48	The current limit used at the time 当时使用的电流限制
Special command	0x03	The values of the special commands register. If a command was executed, the register contains the feedback for the command. 特殊命令寄存器的值。如果执行了一个命令，则寄存器将包含该命令的反馈。
Error register value	0x8F	Active errors at the time the error occurred 错误发生时的已触发错误
ID	N/A	Special ID information for the error 错误的 ID 信息
Timestamp 1 (Device enabled)	N/A	A relative time stamp (seconds) for the entry indicating the time elapsed since the last time the device enabled flag was set 条目的相对时间戳（秒），指示自上次设置启用设备标志后经过的时间
Timestamp 2 (power)	N/A	A relative time stamp (seconds) for the entry indicating the time elapsed since the last power on of the IMD 条目的相对时间戳（秒），指示 IMD 上次通电后经过的时间
Timestamp 3 (life)	N/A	A relative time stamp (seconds) for the entry indicating the time elapsed since the IMD was delivered from the factory, or if the IMD is older, since the first time a firmware supporting error history was installed. This time counter only counts time when the IMD 24 V DC supply (external or internal) is on. 条目的相对时间戳（秒），指示自 IMD 从工厂交付后经过的时间，或者如果 IMD 较旧，则指示自第一次安装支持错误历史记录的固件后经过的时间。此时间计数器只计算 IMD24V 直流电源（外部或内部）打开时的时间。 For IMDs that were delivered with FW older than 1-08-0 (first FW with error log) the life time stamp is relative to the time when the first FW supporting error log was installed on the IMD. 对于固件年龄大于 1-08-0（第一个包含错误日志的固件）的 IMD，寿命戳为相对于 IMD 上安装第一个支持错误日志的固件的时间。

The last error further contains the following parameter values at the time the error occurred (Extra info):
最后一个错误还包含错误发生时的以下参数值（额外信息）：

Information 信息	Register 寄存器	Description 描述
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Information 信息	Register 寄存器	Description 描述
Actual position	0x6D	The actual position based on the resolver and rounds count 基于解析器和转数的实际位置
Actual position SSI	0x6F	The actual position based on the SSI encoder count 基于 SSI 编码器计数的实际位置
1st error in power board	0x94	First error (code) on power board since last clear error command. 自上次清除错误命令后，电源板上出现第一个错误（代码）。
Ballast energy counter (L) and Current overload integral (H)	0x45	Values of Ballast energy counter (low 16 bits), Current overload integral (High16 bits), 镇流能量计数器的值（低 16 位），电流过载积分（高 16 位），
SE voltage	0x66	Numeric value of the safe energy voltage 后备电源电压的数值
SE mid-point voltage	0x61	Numeric value of the safe energy mid-point voltage 后备电源中点电压的数值
T-air	0x4B	Numeric value of the air temperature inside the IMD IMD 内空气温度的数值
(dbg) *temp	0x9A	Dynamic pointer register used for debug by DEIF engineers 由 DEIF 工程师用于调试的动态指针寄存器
(dbg) *ptr1	0xB8	Dynamic pointer register used for debug by DEIF engineers 由 DEIF 工程师用于调试的动态指针寄存器
(dbg) *ptr2	0xBA	Dynamic pointer register used for debug by DEIF engineers 由 DEIF 工程师用于调试的动态指针寄存器
(dbg) ptr1	0xB7	Dynamic pointer register used for debug by DEIF engineers 由 DEIF 工程师用于调试的动态指针寄存器
(dbg) ptr2	0xB9	Dynamic pointer register used for debug by DEIF engineers 由 DEIF 工程师用于调试的动态指针寄存器

The error log also contains a distribution representation of all errors occurred during the “Elapsed time:life” (the time elapsed since the first FW supporting error history was installed), showing how many times each error appears in the log:

错误日志还包含“经过的时间：寿命”（自安装第一个支持错误历史的固件以来）期间发生的所有错误的分布表示，显示每个错误在日志中出现的次数：

Error distribution

0:BADPARAS	0
1:POWERFAULT	3
2:RFE	23
3:BUS TIMEOUT	2
4:FEEDBACK	5
5:UNDervOLTAGE	43
6:MOTORTEMP	1
7:DEVICETEMP	0
8:OVERVOLTAGE	0
9:I_PEAK	0
A:MOTOR OUTPUT	1
B:CHARGER	0
C:HIGHVOLTAGE	0
D:PRE_CHARGE	0
E:HW-ERROR	0
F:BALLAST	0

13. Parameter description 参数说明

This section describes the parameters and CANopen objects that can be used in the IMD. Internal parameters are not included in this description since they have no value for the user. Where bit mapping is relevant, it is described separately in section 13.2 on page 261. The full parameter list can be found in section 13.3 on page 282.

The parameters are identified by their name. Each parameter is mapped to a specific memory registry address (Reg. ID). The same number as the address is also used as a CANopen object. For example, Motor_Nom_V parameter that has a registry address 0x06, has a CANopen object ID: 2006.

本节介绍可在 IMD 中使用的参数和 CANopen 对象。内部参数不包括在本说明中，因为它们对用户没有价值。与位映射相关的部分在第 201 页第 13.2 节中单独描述。完整的参数列表可在第 215 页第 13.3 节中找到。

参数由其名称标识。每个参数都映射到一个特定的内存注册表地址 (Reg.ID)。与地址相同的数字也用作 CANopen 对象。例如，注册地址为 0x06 的 Motor_Nom_V 参数具有 CANopen 对象 ID: 2006。

13.1 Parameter types 参数类型

Parameters are used for different purposes depending on their types. Some parameters are used instead of constants in the SW, some parameters are used to invoke an action, some are for configuration purposes and so on. The purpose of a parameter can be determined by its type. The following table describes the different parameter types:

参数的用途取决于它们的类型。在软件中使用一些参数代替常量，一些参数用于调用操作，一些用于配置目的等。参数的用途可由其类型确定。下表介绍了不同的参数类型：

Table 31 Parameter types

表 31 参数类型

Type 类型	Typical access rights 典型访问权限	Description 描述
Configuration 配置	Read / write 读/写	Parameters used for static configuration of the system. These parameters are typically only configured once before commissioning. Example of a configuration parameter is Maximum peak current (0xC4).用于系统静态配置的参数。这些参数通常仅在调试前配置一次。配置参数的示例是最大峰值电流 (0xC4)。
Status 状态	Read only 仅读	Parameters used for information about different states and other information about the current state of the IMD. Typical example of a state parameter is Logic in block, used to determine the state of the digital inputs (0x9B).用于不同状态信息和 IMD 当前状态信息的参数。状态参数的典型示例是逻辑块，用于确定数字输入 (0x9B) 的状态。
Protected 受保护	Read only 仅读	These parameters are used for values that needs to be configured by the manufacturer, but may not be changed by the users. Even though the seemingly access rights for these parameters are Read/write, it is not possible to write to these parameters. Example of a protected parameter is the Device design current (0xC6).这些参数用于需要制造商配置但用户不能更改的值。即使这些参数看似访问权限是读/写，也无法写入这些参数。受保护参数的示例是器件设计电流 (0xC6)。

Type 类型	Typical access rights 典型访问权限	Description 描述
Set-point 设定点	Read / write 读/写	Parameters that are typically used by the application SW. They would usually be accessed through CAN/CANopen, but they can also be used from the IMD Manager. It is not necessary to invoke an action after a change. Action will be taken automatically by the IMD. An example of a special parameter is a position destination (0x6E). 应用软件通常使用的参数。通常可通过 CAN/CANopen 访问，但也可通过 IMD 监控软件使用。更改后无需调用操作。IMD 将自动采取行动。特殊参数的一个示例是位置目的地（0x6E）。
Special 特殊	Read / write 读/写	Parameters that are typically used by the application SW. They would usually be accessed through CAN/CANopen, but they can also be used from the IMD Manager. It is not necessary to invoke an action after a change. Action will be taken automatically by the IMD. An example of a special parameter is a Device enable (0x51). 应用软件通常使用的参数。通常可通过 CAN/CANopen 访问，但也可通过 IMD 监控软件使用。更改后无需调用操作。IMD 将自动采取行动。特殊参数的一个示例是设备启用（0x51）。
Function 功能	Read / write 读/写	Parameters that invoke and action of the IMD. Typically, it is the write operation to these registers that invokes a specific action. In two functions (EEPROM operations, 0x83 and 0x84) the value of the write operation, defines which configuration to load/save. An example of a function parameter is Cancel Errors (0x8E). 调用和操作 IMD 的参数。通常，调用特定操作的是对这些寄存器的写入操作。在两个功能（EEPROM 操作，0x83 和 0x84）中，写入操作的值定义了要加载/保存的配置。功能参数的一个示例是取消错误（0x8E）。

13.2 Parameter bit mapping 参数位映射

This section describes the mapping of bits in parameters where single or multiple bits represent specific setting or state. 本节描述参数中的位映射，其中单个或多个位表示特定设置或状态。



Attention

“Not used” or “Reserved” bits must not be changed.

注意

“未使用”或“保留”位不可更改。

13.2.1 User options (01) 用户选项 (01)

See also general definition of the parameter in the [parameter list](#).

另请参阅参数列表中参数的一般定义。

Table 32 Reg. ID 0x01, CANopen Object ID 2001

表 32 Reg.ID 0x01, CANopen 对象 ID 2001

Bit 位	Name 名称	Description 描述
Bit 0	TEMP_MOTOR_PT	Motor temperature sensor: 电机温度传感器 0: KTY 84/PTC 1: Pt100
Bit 1	ON_TIME_PT	PT100 filter: PT100 滤波器 0: standard low-pass filter 标准低通滤波器 1: extended low-pass filter 扩展低通滤波器
Bit 2	SSI_TYPE	Type of SSI encoder:SSI 编码器类型: 0: 12+12 (Multi-turn)多转 1: 12+1 (single-turn)单转
Bit 3	Not used	
Bit 4	DIRECT_SAFETY_RUN	Device enabled if no limit switch is active at start-up: 0: Drive must be enabled in order to make a safety run 1: No extra command is needed to initiate a safety-run (disabled if motor temperature < -18°C) 如果启动时没有激活限位开关, 则设备启用: 0: 必须启用驱动器才能进行安全运行 1: 启动安全运行无需额外命令 (如果电机温度<-18°C, 则禁用)
Bit 5	SE_TEST_ANYWHERE	Safe energy test initiation: 0: SE test can only be executed if a limit switch is activated 1: SE test can be executed with no regards to limit switch 后备电源测试启动: 0:SE 测试只能在限位开关激活时执行 1:SE 测试可在不考虑限位开关的情况下执行
Bit 6	AC_RESTART_SAFETY_RUN	Safety run when AC mains return after AC mains missing during safety run: 0: No new safety run 1: A new safety run is automatically initiated when the AC mains returns while the IMD is in state 12 (Safety-run pending). The IMD goes to state 12 if the AC mains is missing during a safety run. 安全运行期间交流电源丢失后, 交流电源返回时的安全运行: 0: 没有新的安全运行 1: 当交流电源返回且 IMD 处于状态 12 (安全运行待定) 时, 自动启动新的安全运行。如果在安全运行期间交流电源丢失, IMD 将进入状态 12。
Bit 7	I_MAX_EXTEND	Permissible value of I max peak: 0: I max pk can be maximum 100% 1: I max pk can be maximum 115% (with reduced T-peak)

Bit 位	Name 名称	Description 描述
		I 最大峰值的允许值: 0:I 最大峰值可为 100% 1:I 最大峰值可为 115% (T 峰减小)
Bit 8..10	Reserved	
Bit 11	CHARGER_ERROR_TRIP_S_CHAIN	Behaviour of the IMD on charger error: 0: Charger errors remain as warnings and do not escalate to errors. Safety-chain is not tripped, and safety run is not performed. 1: Charger errors escalate to errors after the Charger timeout, thus tripping safety-chain and causing a safety run. 充电器错误时 IMD 的行为: 0: 充电器错误作为警告保留, 不会升级为错误。安全链不跳闸, 不执行安全运行。 1: 充电器错误在充电器超时后升级为错误, 从而使安全链跳闸并导致执行安全运行。
Bit 12..14	SE_TEST_PWM_TIME	SE test current resistor PWM or time factors: See description in section 8.4.5 on page 129 . SE 测试电流电阻 PWM 或时间因素: 请参阅第 97 页上的第 8.4.5 节中的说明。
Bit 15	SE_TEST_LONG_SINGLE_PULSE	Enables long single pulse for SE test. See description in section 8.4.5 on page 129 为 SE 测试启用长单脉冲。见第 97 页第 8.4.5 节的说明
Bit 16..18	PREHEAT_CURRENT	Current used during pre-heat:预热期间使用的电流: 0: 1/8 of I con eff 1: 2/8 of I con eff 2: 3/8 of I con eff 3: 4/8 of I con eff 4: 5/8 of I con eff 5: 6/8 of I con eff 6: 7/8 of I con eff 7: 8/8 of I con eff
Bit 19	PREHEAT_MODE	Preheat Mode: 预热模式: 0: Iq from Speed 0 Iq 来自速度 0 1: Iq from Torque 0 Iq 来自扭矩 0
Bit 20.. 21	BALLAST_ENERGY_COOLING	Devisor for adaptation to cooling ability of the ballast resistor. Lowest devisor is for lowest cooling ability. 适应制动电阻冷却能力的装置。最低的装置用于最低的冷却能力。 0: / 8 1: / 6 2: / 4 3: / 2

Bit 位	Name 名称	Description 描述
Bit 22	MANUAL_OP_360_ENABLE	0: The use of manual operation 360 is disabled 禁用手动操作 360 的使用 1: The use of manual operation 360 is enabled 启用手动操作 360 的使用
Bit 23	SCI_STATE_MAN_OP	0: Manual operation can only be used if SCI inputs state is OK 手动操作只有在 SCI 输入状态正常时才能使用 1: Manual operation can only be used if SCI inputs state is not OK 手动操作只能在 SCI 输入状态不正常时使用
Bit 26..27	LVRT_TIMER	Configuration of LVRT timer: 低压穿越定时器配置: 0: LVRT timer is disabled 低压穿越定时器禁用 1: Safety run is performed 5 seconds after a mains failure 主电源故障后 5 秒进行安全运行 2: Safety run is performed 10 seconds after a mains failure 主电源故障 10 秒后进行安全运行 3: Safety run is performed 15 seconds after a mains failure 主电源故障 15 秒后进行安全运行
Bit 28	SAFETY_RUN_RESTART_ON_LS1	New safety run after limit switch 1 cycle: 限位开关 1 循环后的新安全运行: 0: No automatic safety run possible after limit switch 1 is activated and the IMD is in state 16 (parked tripped) 限位开关 1 激活且 IMD 处于状态 16 (停机跳闸) 后, 不可能进行自动安全运行 1: If limit switch 1 is deactivated while in state 16 (parked tripped) a new safety run is automatically initiated 如果限位开关 1 在状态 16 (停机跳闸) 下停用, 则自动启动新的安全运行
Bit 29	S-RUN-SPEED_PROFILE	Enables speed profile in safety run 在安全运行中启用速度配置文件
Bit 30	MANUAL_OP_ENABLE	0: The use of manual operation is disabled 禁用手动操作的使用 1: The use of manual operation is enabled 启用手动操作的使用
Bit 31	BRAKE_HALF_POWER	0: Full output power for the brake 制动器的全输出功率 1: Half output power for the brake 制动器输出功率的一半

13.2.2 User state (02) 用户状态(02)

See also general definition of the parameter in the [parameter list](#) and a description in section [6.1](#) on page [68](#), where most of the states are described. In the full list that follows, the path states are also listed. Path states are states that are used to get into (xx entry), or get out from another state (xx exit).

Some debug states are omitted from the list.

另见参数列表中参数的一般定义和第 55 页第 6.1 节中的描述，其中描述了大多数状态。在下面的完整列表中，还列出了路径状态。路径状态是用于进入（xx 入口）或从另一个状态（xx 出口）退出的状态。

列表中省略了一些调试状态。

Table 33 Reg. ID 0x02, CANopen Object ID 2002

表 33 Reg.ID 0x02, CANopen 对象 ID 2002

Value 值	State 状态
0	PwrOn Delay 通电延迟
1	Normal Operation 正常操作
2	PwrOn Checking 通电检查
3	PwrOn @Parked 上电后停机
4	PwrOn not parked cold 上电后未停机 电机冷态
5	PwrOn not parked 上电后未停机
6	Start-up Fatal error 启动严重错误
7	PwrOn @Parked tripped 停机时安全链断开
8	CAN timeout CAN 超时
9	Blind safety run initiate 开环顺桨运行启动
10	Error- SCR tripped 错误-SCR 跳闸
11	Safety run step 0 安全运行步骤 0
12	Safety run pend. 安全运行暂停。
13	Park not enable 未启用停机
14	Safety run succeeded 安全运行成功
15	Safety run timeout 安全运行超时
16	Parked tripped 停机跳闸
17	Parked ready 停机准备就绪
18	Safety-run timed out 安全运行超时
19	Safety run setup 安全运行设置
20	Park blind safety run exit 退出开环顺桨运行
21	SE-test entry SE-测试进入
22	SE-test HV SE-测试高压
23	SE-test HV rest SE-测试高压休息
24	SE-test ready SE-测试准备就绪
25	SE-test PWM ON SE 测试 PWM 接通

Value 值	State 状态
26	SE-test rest 0 SE 测试休息 0
27	SE-test rest 1 SE 测试休息 1
28	SE-test PWN rest SE 测试 PWN 休息
29	SE-test ready PWM SE 测试就绪 PWM
30	SE-test exit SE 测试退出
31	Pre-heating entry 预热进入
32	Pre-heating on 预热开启
33	Pre-heating exit 预热退出
34	Pos. Preset entry 位置预设进入
35	Pos. Preset 位置预设
36	Pos. Preset exit 位置预设退出
37	Batt SC trip 电池 SC 跳闸
38	Pos. store cmd 位置 存储命令
39	Pos. store timed 位置 存储定时
40	Brake test 制动测试
41	Brake test exit 制动测试退出
42	Pre-heating warning 预热警告
43	Usr Oper. Mains, disconnect Usr 操作。电源，断开
51	Pos. store timed Mains, disconnect 位置存储定时电源，断开
52	SE-test pulse ON SE 测试脉冲打开
53	SE-test pulse rest 测试脉冲休息
54	Safety run step 1 安全运行步骤 1
55	Safety run step 2 安全运行步骤 2
56	Safety run step 3 安全运行步骤 3
57	Safety run step 4 安全运行步骤 4
58	Safety run setup 0 安全运行设置 0
59	Manual operation mode 手动操作模式
60	Manual operation mode exit 手动操作模式退出

13.2.3 User demand (03)用户需求 (03)

The user demand register defines and initiates the actions available with Special commands.

See also general definition of the parameter in the [parameter list](#). This is the full list that is also used as feedback.

用户需求寄存器定义并启动特殊命令可用的操作。

另请参阅参数列表中参数的一般定义。这也是用作反馈的完整列表。

Table 34 Reg. ID 0x03, CANopen Object ID 2003

表 34 Reg. ID 0x03, CANopen 对象 ID 2003

Value 值	Name 名称	Description 描述
0	Idle 闲置	Use to terminate present function 用于终止当前功能
1	Illegal / unexpected cmd from this state / condition 此状态/条件下的非法/意外 cmd	A special command that is not legal or from the present state or condition was executed 执行了不合法或不符合当前状态或条件的特殊命令
2	Pre-heating 预热	Starts pre-heat 开始预热
3	SE-test initiated SE 测试启动	Initiates a safe energy test 启动后备电源测试
4	Position preset 位置预设	Enables preset position 启用预设位置
5	SE-test, PWM load ON SE 测试, PWM 负载开启	Turns output modulation for safe energy test on 打开用于后备电源测试的输出调制
6	SE-test load OFF SE-测试负载关闭	Turns output for safe energy test off. This command will also stop a pulse. 关闭安全能量测试的输出。此命令还将停止脉冲。
7	Store position 储存位置	Stores present position 存储当前位置
8	Brake test ON 制动测试开启	Initiates a brake test 启动制动测试
9	RUN input is low RUN 输入低	The requested command cannot be executed because the RUN input is low 无法执行请求的命令, 因为 RUN 输入过低
10	Enabled is still ON 启用仍处于开启状态	The requested command cannot be executed because the device is still enabled 无法执行请求的命令, 因为设备仍处于启用状态
11	Enabled is still OFF 启用仍处于关闭状态	The requested command cannot be executed because the device is still disabled 无法执行请求的命令, 因为设备仍处于禁用状态
12	Mains disconnect 电源断开	Disconnects AC mains from the DC-link 断开交流电源与直流母线的连接
13	Mains connect	Connects AC mains to the DC-link

Value 值	Name 名称	Description 描述
	电源连接	将交流电源连接到直流母线
14	Trip SCR output 跳闸 SCR 输出	Turns the Safety-chain relays off 关闭安全链继电器
15	SE-test, single pulse load ON SE 测试, 单脉冲负载开启	Turns output pulse for safe energy test on 开启安全能量测试输出脉冲
16	Mains OFF HV 电源关闭 高压	Disconnects AC mains from the DC-link, with no possibility of automatic reconnection 断开交流电源与直流母线的连接, 不可能自动重新连接
17	Fan ON 风扇开启	Turns the fan on 打开风扇
18	Fan OFF 风扇关闭	Turns the fan off. 关闭风扇
19	USR_DEMAND_19 用户需求 19	Not used 未使用
20	USR_DEMAND_20 用户需求 20	Not used 未使用
21	Restart IMD 重启 IMD	Restarter the IMD. Se section 9.12 on page 190 for more information. 重新启动 IMD。更多信息请参见第 144 页第 9.12 节。
22	Enable IMD restart 启用 IMD 重启	Enables IMD restart through special commands (command 21) in the IMD manager, or through CAN. Se section 9.12 on page 190 for more information. 通过 IMD 监控软件中的特殊命令 (命令 21) 或 CAN 启用 IMD 重启。更多信息请参见第 144 页第 9.12 节。
26	Disable manual operation command 禁用手动操作命令	Manual operation is disabled. 已禁用手动操作。 <ul style="list-style-type: none"> If not in manual operation state, it is not possible to go into manual operation. 如果未处于手动操作状态, 则无法进入手动操作。 If in manual operation state, it is not possible to move the motor. 如果处于手动操作状态, 则无法移动电机。
27	Cancel special command 26 取消特殊命令 26	Cancels special command 26. If register 0x01 bit 30 = 1, manual operation can be used again. 取消特殊命令 26。如果寄存器 0x01 位 30=1, 则可以再次使用手动操作。
28	SE discharge ON SE 放电开启	Connects the ballast resistor to the safe energy to discharge ultra-capacitors. Se section 9.13 on page 193 for more information. 将制动电阻连接到后备电源以对超级电容器放电。有关更多信息, 请参阅第 147 页上的第 9.13 节。
29	SE discharge OFF SE 放电关闭	Disconnects the ballast resistor from the safe energy to stop discharging ultra-capacitors. Se section 9.13 on page 193 for more information 将制动电阻与安全能量断开以停止对超级电容器放电。有关详细信息, 请参阅第 147 页上的第 9.13 节

Value 值	Name 名称	Description 描述
31	Clear errors 清除错误	Clears errors in the IMD. Has the same function as the “Clear errors” button in the IMD manager.清除 IMD 中的错误。与 IMD 监控软件中的“清除错误”按钮功能相同。
32	Initiate safety-run 启动安全运行	Initiates a safety run. Has the same function as the “S-run” button in the IMD manager.启动安全运行。与 IMD 监控软件中的“S-run”按钮功能相同。

13.2.4 Drive status (40)驱动器状态 (40)

See also general definition of the parameter in the [parameter list](#).

This register is read only and indicates the status of different functions in the IMD.

另请参阅参数列表中参数的一般定义。

该寄存器是只读的，用于指示 IMD 中不同功能的状态。

Table 35 Reg. ID 0x40, CANopen Object ID 2040

表 35 Reg. ID 0x40, CANopen 对象 ID 2040

Bit 位	Name 名称	Description 描述
Bit 0	Dev.Enabled	0: Drive disabled, 1: Drive enabled (hardware enable) 0:驱动器禁用, 1:驱动器启用(硬件启用)
Bit 1	NcR0	1: Speed control (as well as torque control) is disabled. The switch to the speed ramp is disabled and the N cmd (ramp) is set to zero. 1: 禁用速度控制(以及扭矩控制)。速度坡道开关被禁用, N cmd (坡道) 设置为零。
Bit 2	Lim.sw+	1: The logical input assigned as Limit plus is active 1: 分配为限制加的逻辑输入有效
Bit 3	Lim.sw-	1: The logical input assigned as Limit minus is active 1: 分配为限制减的逻辑输入有效
Bit 4	OK 正常	This flag is turned on (from 0 to 1) the first time the IMD is enabled, and stays on as long as the IMD has power (24 V DC). Once active, it stays active with no regards to the state of the IMD. 该标志在 IMD 第一次启用时打开(从 0 到 1), 并在 IMD 通电(24 V DC) 时保持打开状态。一旦激活, 它将保持激活状态, 与 IMD 的状态无关。
Bit 5	I_red_to_I-con-eff	1: Current is limited (reduced) to I-con-eff (I-nom) due to 100% overload energy integral 1: 由于 100% 过载能量积分, 电流被限制(降低)为 I-con-eff (I-nom)
Bit 6	N-limited T mode	1: when all the following conditions are true: 1: 当以下所有条件都为真时:

Bit 位	Name 名称	Description 描述
		<ul style="list-style-type: none"> Speed limit in torque mode is active (M-set, Reg. 0x90 <> 0) 扭矩模式下的速度限制激活 (M-set, Reg. 0x90<>0) Motor is running 电机正在运行 N-limit is < 100% N-限值<100%
Bit 7	Position-control 位置控制	1: Position control is enabled (Pos Kp > 0) 1: 启用位置控制 (位置 Kp>0)
Bit 8	Speed-control 速度控制	1: Speed control is enabled (Speed Kp > 0) 1: 启用速度控制 (速度 Kp>0)
Bit 9	Low speed 低速度	1: Actual speed is very low (almost stopped) 1: 实际速度非常低 (几乎停止)
Bit 10	Ref.sw	1: The logical input assigned as Ref.sw is active. If two inputs are defined as Ref.sw, any of the inputs can turn this ON (1). 1: 分配为 Ref.sw 的逻辑输入激活。如果两个输入被定义为 Ref.sw, 则任何输入均可开启 (1)。
Bit 11	Cal0	1: The IMD state is Safety run (state 11) 1: IMD 状态为安全运行 (状态 11)
Bit 12	Cal	1: The IMD state is Normal operation (state 1). 1: IMD 状态为正常操作 (状态 1)。
Bit 13	Tol	1: Actual position within the position tolerance window 1: 位置公差窗口内的实际位置
Bit 14	SCR 1 and 2	0: Safety Chain Relay output is open (tripped) 1: Safety Chain Relay output is closed (OK) 0: 安全链继电器输出打开 (跳闸) 1: 安全链继电器输出关闭 (正常)
Bit 15	Brake delay on 制动延迟开启	1: Brake delay is active (only while the delay is actually active) 1: 制动延迟激活 (仅当延迟实际激活时)
Bit 16	SignMag	1: The speed value is reversed through logic input (N cmd Reverse) 1:通过逻辑输入反转速度值(N cmd Reverse)
Bit 17	N limit N 限制	1: when all the following conditions are true:当以下所有条件均为真时: <ul style="list-style-type: none"> When the N-limit (Reg. 0x34) is configured to < 90% 当 N 限值 (Reg.0x34) 配置为<90% The IMD is in Normal operation state. IMD 处于正常操作状态。
Bit 18	N limit + N 限制+	1: when all the following conditions are true:当以下所有条件均为真时: <ul style="list-style-type: none"> Positive direction speed limit is configured to <100%正向速度

Bit 位	Name 名称	Description 描述
		<p>限制配置为<100%</p> <ul style="list-style-type: none"> N-clip is enabled (either through logic input configuration or through CAN command)N-clip 已启用（通过逻辑输入配置或通过 CAN 命令） The IMD is in normal operation state.IMD 处于正常操作状态。
Bit 19	N limit - N 限制-	<p>1: when all the following conditions are true:当以下所有条件均为真时:</p> <ul style="list-style-type: none"> Negative direction speed limit is configured to <100%反向速度限制配置为<100% N-clip is enabled (either through logic input configuration or through CAN command)N-clip 已启用（通过逻辑输入配置或通过 CAN 命令） The IMD is in normal operation state.IMD 处于正常操作状态。
Bit 20	I red:I-lim-SE-Dig	<p>1: when all the following conditions are true:当以下所有条件均为真时:</p> <ul style="list-style-type: none"> I-lim-SE-Dig limit is configured to <100% I-lim-SE-Dig 限制配置为<100% I-lim-SE-Dig is enabled (either through logic input configuration or through CAN command or AC mains supply missing I-lim-SE-Dig 已启用（通过逻辑输入配置或通过 CAN 命令或交流电源缺失
Bit 21	I max-overl-reached	<p>1: The maximum allowed overload energy integral is reached. 1: 达到最大允许过载能量积分。</p>
Bit 22	I reduced:I-red-N	<p>1: The current is limited due to speed above I-red-N 1: 由于速度高于 I-red-N，电流受到限制</p>
Bit 23	I reduced:I-red-TD	<p>1: Current is limited (less than I max) because drive temperature reached I-red-TD 1: 由于驱动器温度达到 I-red-TD，电流受到限制（小于 I max）</p>
Bit 24	I reduced:I-red-TE	<p>1: Current is limited to I-nom because drive temperature reached I-red-TE 1: 由于驱动器温度达到 I-red-TE，电流被限制为 I-nom</p>
Bit 25	>10Hz	<p>1: Output frequency is higher than 10Hz 1: 输出频率高于 10Hz</p>
Bit 26	I reduced:I-red-TM	<p>1: The current is reduced because motor temperature reached I-red-TM 1: 由于电机温度达到 I-red-TM，电流降低</p>
Bit 27	Ird-Ana	Not used 未使用
Bit 28	Overload-warning	1: The overload energy is almost used

Bit 位	Name 名称	Description 描述
	过载警告	1: 过载能量几乎用完
Bit 29	Reserved 保留	Not used 未使用
Bit 30	I-limit-M-mode	Configuration state of maximum current limit (configured by 0x52, CAN):最大电流限制的配置状态（由 0x52 配置，CAN）： 0: I _{max pk} (0xC4) is used as current limit 0:I _{max pk} (0xC4) 用作电流限制 1: The smallest value of Motor I _{max} (0x4D) and I _{max pk} (0xC4) is used as current limit 1: 电机 I _{max} (0x4D) 和 I _{max pk} (0xC4) 的最小值用作电流限制
Bit 31	HndWhl	Not used 未使用

13.2.5 Device mode (51)设备模式 (51)

Changing a bit in this register to one executes a command. The command is executed once and the register keeps the last value written. To execute another command or the same command again, write to the register again. This register is used by the application SW during operation.

See also general definition of the parameter in the [parameter list](#).

将此寄存器中的一位更改为 1 将执行一条命令。执行一次命令，寄存器保留最后写入的值。要再次执行另一个命令或相同的命令，请再次写入寄存器。该寄存器在操作期间由应用程序软件使用。

另请参阅参数列表中参数的一般定义。

Table 36 Reg. ID 0x51, CANopen Object ID 2051

表 36 Reg. ID 0x51, CANopen 对象 ID 2051

Bit 位	Name 名称	Description 描述
Bit 0	Reserved 保留	
Bit 1	SPEED = 0 速度 = 0	Forced speed command value = 0 (NcR0). No speed command is executed while this bit = 1. 强制速度指令值 = 0 (NcR0)。该位 = 1 时不执行速度命令。
Bit 2	ENABLE OFF 启用关闭	Disable Drive 禁用驱动器
Bit 3	Reserved 保留	
Bit 4	Reserved 保留	
Bit 5	I-LIMIT-DIG	Activate I-lim-SE-Dig 激活 I-lim-SE-Dig
Bit 6	N-clip	Activate "N limit+" and "N limit-" speed limiting 启动 "N 极限+" 和 "N 极限-" 限速
Bit 7	Reserved 保留	
Bit 8	Reserved 保留	

Bit 位	Name 名称	Description 描述
Bit 9	Reserved 保留	
Bit 10	Reserved 保留	
Bit 11-15	Not defined 未定义	

13.2.6 Device option (5A)设备选项 (5A)

See also general definition of the parameter in the [parameter list](#).

另请参阅参数列表中参数的一般定义。

Table 37 Reg. ID 0x5A, CANopen Object ID 205A

表 37 Reg. ID 0x5A, CANopen 对象 ID 205A

Bit 位	Short symbol 短符号	Description 描述
Bit 0	Reserved 保留	
Bit 1	BALLAST_EXT	Overload calculation algorithm. Must always be 1 过载计算算法。必须始终为 1
Bit 2	Reserved 保留	
Bit 3	CoastStop 惯性滑块停机	0: Coast-stop off. The motor is held in position also when stopped 1: Coast-stop on. The motor is in free run when stopped Use always zero. 0: 惯性滑块停机关闭。电机停止时也保持在原位 1: 惯性滑块停机开启。电机停止时处于自由运转状态 始终使用零。
Bit 4	Reserved 保留	Protected bit, HW depended setting 受保护位，硬件取决于设置
Bit 5	Reserved 保留	Do not change 不改变
Bit 6	Reserved 保留	Do not change 不改变
Bit 7	Reserved 保留	Protected bit, HW depended setting 受保护位，硬件取决于设置
Bit 8	Start-up DELAY 启动延迟	0: No delay (default) 1: Additional start-up delay (1.8 s) 0: 无延迟（默认） 1: 附加启动延迟（1.8 s）
Bit 9	Reserved 保留	Do not change 不改变
Bit 10	Reserved 保留	Do not change 不改变
Bit 11	Reserved 保留	Do not change 不改变
Bit 12..13	MotorType 电机类型	0: Sync.Servo 同步伺服 1: Async. V/F (without resolver)异步. V/F（不带编码器）

Bit 位	Short symbol 短符号	Description 描述
		2: Async.Servo 异步伺服 3: DC motor 直流电机
Bit 14	Reserved 保留	Protected bit, HW depended setting 受保护位，硬件取决于设置
Bit 15	lowbd	Baud rate for serial/USB connection (always use zero): 串行/USB 连接的波特率（始终使用零）： 0: 115200 1: 9600
Bit 16	Reserved 保留	Do not change 不改变
Bit 17	Reserved 保留	Do not change 不改变
Bit 18	Reserved 保留	Do not change 不改变
Bit 19	Reserved 保留	Protected bit, HW depended setting 受保护位，硬件取决于设置
Bit 20..22	PWMfr	Switching frequency. Only values 0, 4, 6 and 7 are supported. 开关频率。仅支持值 0、4、6 和 7。 0: 8 kHz 1: 24 kHz 2: 20 kHz 3: 16 kHz 4: 12 kHz 5: 8 kHz i16 6: 6 kHz i12 7: 4 kHz i8
Bit 23	NTC	0: Positive motor temperature sensor 1: NTC Temp-motor (SW change of the proportional error and warning limits only) 0: 正极电机温度传感器 1: NTC 温度电机（仅限比例误差和警告限值的软件更改）
Bit 24	Reserved 保留	Do not change 不改变
Bit 25	DC_1QdirVolt	Protected bit, HW depended setting 受保护位，硬件取决于设置
Bit 26	DC_field	DC motor with field control. Not supported. 带磁场控制的直流电机。不支持。
Bit 27	DEAD_2	deadband*2 死区*2
Bit 28	Reserved 保留	Not used 未使用
Bit 29	DC_1QMV	DC motor related. Do not change. 直流电机相关。不改变。
Bit 30	DC_1Q3P	DC motor related. Do not change. 直流电机相关。不改变。
Bit 31	Reserved 保留	Do not change 不改变

13.2.7 Errors/warnings (8F)错误/警告 (8F)

See also general definition of the parameter in the [parameter list](#).

See errors and warnings description in section [12.1](#) on page [249](#).

另请参阅参数列表中参数的一般定义。

请参阅第 193 页第 12.1 节中的错误和警告说明。

Table 38 Reg. ID 0x8F, CANopen Object ID 208F

表 38 Reg. ID 0x8F, CANopen 对象 ID 208F

Bit 位	Name 名称
Bit 0	Error 0: BADPARAS 错误 0:参数错误
Bit 1	Error 1: POWER FAULT 错误 1: 电源故障
Bit 2	Error 2: RFE open 错误 2: RFE 打开
Bit 3	Error 3: BUS TIMEOUT 错误 3: 总线超时
Bit 4	Error 4: FEEDBACK 错误 4: 反馈
Bit 5	Error 5: UNDERVOLTAGE 错误 5: 欠压
Bit 6	Error 6: MOTORTEMP 错误 6: 电机温度
Bit 7	Error 7: DEVICETEMP 错误 7: 设备温度
Bit 8	Error 8: OVERVOLTAGE 错误 8: 超压
Bit 9	Error 9: I_PEAK 错误 9: I_峰值
Bit 10	Error A: MOTOR OUTPUT 错误 A: 电机输出
Bit 11	Error B: CHARGER 错误 B: 充电器
Bit 12	Error C: HIGHVOLTAGE 错误 C: 高压
Bit 13	Error D: PRE_CHARGE 错误 D: 预充电
Bit 14	Error E: HW-ERROR 错误 E:硬件错误
Bit 15	Error F: BALLAST 错误 F: 镇流器
Bit 16	Warning 0: BADPARAS 警告 0:参数错误
Bit 17	Warning 1: Warning 1 (not used) 警告 1: 警告 1 (未使用)

Bit 位	Name 名称
Bit 18	Warning 2: Warning 2 (not used)警告 1: 警告 1（未使用）
Bit 19	Warning 3: COMCHARGER 警告 3: COMCHARGER
Bit 20	Warning 4: FEEDBACK 警告 4: 反馈
Bit 21	Warning 5: POWERVOLTAGE 警告 5: 电源电压
Bit 22	Warning 6: MOTORTEMP 警告 6: 电机温度
Bit 23	Warning 7: DEVICETEMP 警告 7: 设备温度
Bit 24	Warning 8: Warning 8 (not used) 警告 8: 警告 8（未使用）
Bit 25	Warning 9: I_PEAK 警告 9:I_峰值
Bit 26	Warning A: Warning A (not used) 警告 A: 警告 A（未使用）
Bit 27	Warning B: CHARGER 警告 B: 充电器
Bit 28	Warning C: HIGHVOLTAGE 警告 C: 高压
Bit 29	Warning D: Warning D (not used) 警告 D: 警告 D（未使用）
Bit 30	Warning E: HW-warning 警告 E:硬件警告
Bit 31	Warning F: BALLAST 警告 F: 镇流器

13.2.8 Logic Out block (98)逻辑输出块 (98)

See also general definition of the parameter in the [parameter list](#).

另请参阅参数列表中参数的一般定义。

Table 39 Reg. ID 0x98, CANopen Object ID 2098

表 39 Reg. ID 0x98, CANopen 对象 ID 2098

Bit 位	Name 名称	Description 描述
Bit 0	DO1	0: Dout 1 OFF, 1: Dout 1 ON 0:Dout 1 关闭, 1:Dout 1 打开

Bit 位	Name 名称	Description 描述
Bit 1	DO2	0: Dout 2 OFF, 1: Dout 2 ON 0:Dout 2 关闭, 1:Dout 2 打开
Bit 2	DO3	0: Dout 3 OFF, 1: Dout 3 ON 0:Dout 3 关闭, 1:Dout 3 打开
Bit 3	DO4	0: Dout 4 OFF, 1: Dout 4 ON 0:Dout 4 关闭, 1:Dout 4 打开
Bit 4	DO5	0: Dout 5 OFF, 1: Dout 5 ON. Can also be mapped from “Logic-5” 0:Dout 5 关闭, 1:Dout 5 打开。也可以从“逻辑-5”映射
Bit 5	DO6	0: Dout 6 OFF, 1: Dout 6 ON. Can also be mapped from “Logic-6” 0:Dout 6 关闭, 1:Dout 6 打开。也可以从“逻辑-6”映射
Bit 6	DO7	0: Dout 7 OFF, 1: Dout 7 ON. Can also be mapped from “Logic-7” 0:Dout 7 关闭, 1:Dout 7 打开。也可以从“逻辑-7”映射
Bit 7	DO8	0: Dout 8 OFF, 1: Dout 8 ON. Can also be mapped from “Logic-8” 0:Dout 8 关闭, 1:Dout 8 打开。也可以从“逻辑-8”映射
Bit 8	RO	0: RO OFF, 1: RO ON 0:RO 关闭, 1:RO 打开
Bit 9 - 15	Not used 未使用	

13.2.9 Logic in block (9B)逻辑块 (9B)

See also general definition of the parameter in the [parameter list](#). 另请参阅参数列表中参数的一般定义。

Table 40 Reg. ID 0x9B, CANopen Object ID 209B

表 40 注册 Reg. ID 0x9B, CANopen 对象 ID 209B

Bit 位	Short symbol 短字符	Description 描述
Bit 0	RFE	0: disable the IGBTs by hardware, 1: enable operation 0: 通过硬件禁用 IGBT, 1: 启用操作
Bit 1	RUN	0: motor drive is disabled, 1: motor drive is enabled 0:电机驱动器被禁用, 1:电机驱动器被启用
Bit 2	LS_1	0: limit switch 1 is not activated, 1: limit switch 1 is activated 0:限位开关 1 未激活, 1:限位开关 1 激活
Bit 3	LS_2	0: limit switch 2 is not activated, 1: limit switch 2 is activated 0:限位开关 2 未激活, 1:限位开关 2 激活
Bit 4	DI1	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开

Bit 位	Short symbol 短字符	Description 描述
Bit 5	DI2	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 6	DI3	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 7	DI4	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 8	DI5	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 9	DI6	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 10	DI7	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 11	DI8	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 12	DI9	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 13	DI10	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 14	DI11	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 15	DI12	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 16	SCI1	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 17	SCI2	0: Input is off, 1: input is on 0:输入关闭, 1:输入打开
Bit 18	X7 high	0: No voltage in X7, No power to brake output, 1: 24 V on X7 0:X7 无电压, 制动输出无电源, X7 上为 1:24 V
Bit 19		Not used 未使用
Bit 20	REGEN_25pc	Ballast load >= 25% 镇流器负载 >= 25%
Bit 21	T_IGBT_60	Temp IGBT >= 60°C (hysteresis: off <55°C) 温度 IGBT >= 60° C (滞后: 关闭 <55° C)
Bit 22		Not used 未使用

Bit 位	Short symbol 短字符	Description 描述
Bit 23	FAN	0: Fan not turning. 1: Fan turning. 0: 风扇未转动。 1: 风扇转动。
Bit 24..27	SWITCH	Address of CAN ID switch on the front of the IMD (0 to 15) IMD 前面的 CAN ID 开关地址 (0 到 15)
Bit 28	BRK_OK	Indication of the brake connection status. 0: Impedance not within the expected range. Brake might not be connected, or another brake type is used. 1: Brake is connected. 制动器连接状态指示。 0: 阻抗不在预期范围内。制动器可能未连接，或使用了其他制动器类型。 1: 制动器已连接。
Bit 29	MAIN_OFF	0: Mains OK. 1: No mains present or IMD in grid-off mode. 0: 电源正常。 1: 无电源或 IMD 处于电网关闭模式。
Bit 30	OUT_ERR	0: Digital outputs OK. 1: Digital outputs driver overload, or no supply to digital outputs on X8 (term. 11,20). All digital outputs are turned off. 0: 数字输出正常。 1: 数字输出驱动器过载，或数字输出无电源在 X8 (term. 11,20) 上。所有数字输出都关闭。
Bit 31	SSI	0: no SSI connection detected, 1: SSI connection detected 0: 未检测到 SSI 连接，1: 检测到 SSI 连接

13.2.10 User motor options (A4) 用户电机选项 (A4)

See also general definition of the parameter in the [parameter list](#). 另请参阅参数列表中参数的一般定义。

Table 41 Reg. ID 0xA4, CANopen Object ID 20A4

表 41 Reg. ID 0xA4, CANopen 对象 ID 20A4

Bit 位	Value 值	Short symbol 短字符	Function 功能
Bit 0..4 Position feedback selection 位置反馈选	1	Resolver 编码器	Feedback resolver 反馈编码器
	12	Sensorless 无传感器	Control without feedback sensor 无反馈传感器控制

Bit 位	Value 值	Short symbol 短字符	Function 功能
择			
Bit 5..15			Reserved 保留



Info

Use only the listed values.

信息

仅使用列出的值。

13.2.11 Logic in/out block state (D8)逻辑输入/输出块状态 (D8)

See also general definition of the parameter in the [parameter list](#). 另请参阅参数列表中参数的一般定义。

Table 42 Reg. ID 0xD8, CANopen Object ID 20D8

表 42 Reg.ID 0xD8, CANopen 对象 ID 20D8

Bit 位	Name 名称	Description 描述
Bit 0	Limit 1	0: Digital input limit 1 inactive, 1: Digital input limit 1 active 0:数字输入限制 1 未激活, 1:数字输入限制 1 激活
Bit 1	Limit 2	0: Digital input limit 2 inactive, 1: Digital input limit 2 active 0:数字输入限制 2 未激活, 1:数字输入限制 2 激活
Bit 2	Din 2	Result of Din2 logic: 0: Din2 false, 1: Din 2 true Din2 逻辑的结果: 0:Din2 为假, 1:Din2 为真
Bit 3	Din 1	Result of Din1 logic: 0: Din1 false, 1: Din 1 true Din1 逻辑的结果: 0:Din1 为假, 1:Din1 为真
Bit 4	RUN	0: Hardware enable inactive, 1: Hardware enable active 0:硬件启用未激活状态, 1:硬件启用激活
Bit 5	RFE	0: motor drive disabled, 1: motor drive enabled 0:电机驱动器禁用, 1:电机驱动器启用
Bit 6		Not used 未使用
Bit 7		Not used 未使用
Bit 8	Dout 1	0: Digital output Dout 1 inactive, 1: Digital output Dout 1 active 0: 数字输出 1 未激活, 1: 数字输出 1 激活
Bit 9	Dout 2	0: Digital output Dout 2 inactive, 1: Digital output Dout 2 active 0: 数字输出 2 未激活, 1: 数字输出 2 激活
Bit 10	SCR 1 and 2	0: Hardware relay output SCR inactive, 1: Hardware relay output SCR active 0: 硬件继电器输出 SCR 未激活, 1: 硬件继电器输出 SCR 激活

Bit 位	Name 名称	Description 描述
Bit 11	GO	0: Internal enable GO inactive, 1: Internal enable GO active 0:内部启用 GO 未激活, 1:内部启用 GO 激活
Bit 12	Dout 3	0: Digital output Dout 3 inactive, 1: Digital output Dout 3 active 0: 数字输出 Dout 3 未激活, 1: 数字输出 Dout 3 激活
Bit 13	Dout 4	0: Digital output Dout 4in active, 1: Digital output Dout 4 active 0: 数字输出 Dout 4 未激活, 1: 数字输出 Dout 4 激活
Bit 14	Mains, disconnect	0: Connection from rectifier to DC-link is ON, 1: Connection from rectifier to DC-link is Off 0: 整流器到直流母线的连接打开, 1: 整流器到直流母线的连接关闭
Bit 15	Brk1	0: brake delay inactive, 1: brake delay active 0: 制动延迟未激活, 1: 制动延迟激活

13.3 Parameter list 参数表

Some parameters which are not relevant are not described in this list. When a register is divided into two parts (H and L) each part is half of the register data type. Retrieval of data can only be done on a whole register. If the needed data is only part of the register (high/low), it must be processed after the register data is retrieved. Writing of data can only be done on a whole register. If the needed data is only part of the register (high/low), it must be processed before writing, so the whole 32 bits are written to the register.

In the parameter list table, divided registers are noted as H/L as well as the corresponding CAN objects, to indicate that multiple values are used within the same register.

一些不相关的参数不在此列表中描述。当一个寄存器被分成两部分（H 和 L）时，每一部分都是寄存器数据类型的一半。数据的检索只能在整个寄存器上进行。如果需要的数据只是寄存器的一部分（高/低），则必须在检索到寄存器数据后进行处理。数据写入只能在整个寄存器上完成。如果需要的数据只是寄存器的一部分（高/低），则必须在写入前进行处理，因此将整个 32 位写入寄存器。

在参数列表中，划分的寄存器分开的寄存器被标注为 H/L 以及相应的 CAN 对象，以表明在同一寄存器中使用了多个值。

Table 43 Parameter list 参数表

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
0x01	2001	User_options	Configuration 配置	See bit mapping in section 13.2.1 on page 261 请参阅第 201 页上的第 13.2.1 节中的位映射	Binary bit mapping 二进制位映射	N/A	0x00000002	U32	RW / RW
0x02	2002	User_State	Status 状态	See value definition in section 13.2.2 on page 264 请参阅第 203 页上的第 13.2.2 节中的值定义	N/A	Num	N/A	U16	RO / RO
0x03	2003	User_demand	Function 功能	See value mapping in section 13.2.3 on page 267 . 请参阅第 205 页上的第 13.2.3 节中的值映射。	0..32	Num	N/A	U16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
0x05	2005	Fnom	Configuration 配置	Rated motor frequency 额定电机频率	1 .. 12000	Hz*10	2000	U16	RW / RW
0x06	2006	Unom	Configuration 配置	Rated motor voltage 额定电机电压	0 .. 1000	V	0	U16	RW / RW
0x07 L	2007 L	UF_T-DC	Configuration 配置	Pre-magnetisation time 预磁化时间	10 .. 2000	ms	0	U32	RW / RW
0x08 L	2008 L	UF_U-DC	Configuration 配置	Voltage for pre- magnetisation 预磁化电压	0.1 .. 100.0	% DC-Bus	0	U32	RW / RW
0x0A L	200A L	UF_Umin	Configuration 配置	Min. voltage (boost) 最小电压 (升压)	0 .. 100	% DC-Bus	0	U32	RW / RW
0x0B L	200B L	UF_Fmin	Configuration 配置	Min. Frequency 最小频率	0.0 .. 100.0	Hz	0	U32	RW / RW
0x0C L	200C L	UF_Ucorner	Configuration 配置	Max. Voltage 最大电压	0.0 .. 100.0	%	0	U32	RW / RW
0x0D L	200D L	UF_Fcorner	Configuration 配置	Frequency with max. Voltage 最大电压下的频率	1.0 .. 1000.0	Hz	0	U32	RW / RW
0x0E	200E	UF_PowF	Configuration 配置	Motor power factor (cos F) 电机功率因数 (cos F)	0 .. 65535	%	0	U16	RW
0x1B	201B	Kern_Version / Firmware	Status 状态	Firmware version 固件版本	N/A	N/A	N/A	U16	RO / RO
0x1C	201C	I -Kp	Configuration 配置	Current control Proportional amplification 电流控制比例放大	0 .. 100	Num	10	U16	RW / RW
0x1D	201D	I -Ti	Configuration	Current control Integration time	0 .. 10000	µs	600	U16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
			配置	电流控制积分时间					
0x1E	201E	Dig_CutOff	Configuration 配置	Cutoff digital command in torque control mode 扭矩控制模式下的切断数字指令	0 .. 32767	Num	0	U16	RW / RW
0x20	2020	I -Actual	Status 状态	Actual current value 实际电流值	See section 10.4 on page 244 见第 189 页第 10.4 节	Num	N/A	I16	RO / RO
0x21	2021	I set(dig)	Set-point 设定值	Current set-point 电流设定值	See section 10.4 on page 244 见第 189 页第 10.4 节	Num	0	I16	RW / RW
0x22	2022	lcmd(ramp)	Status 状态	Current (I) command value 电流 (I) 指令值	See section 10.4 on page 244 见第 189 页第 10.4 节	Num	N/A	I16	RO / RO
0x23	2023	Id-ref	Status 状态	D-current (reactive) reference D-电流（无功）基准	See section 10.4 on page 244 见第 189 页第 10.4 节	Num	N/A	I16	RO / RO
0x24	2024	Imax inuse	Status 状态	Limit of the maximum allowed current at present time. 当前最大允许电流的限制	See section 10.4 on page 244 见第 189 页第 10.4 节	Num	N/A	U16	RO / RO
0x25	2025	Ramp time	Configuration 配置	Ramp time for 100 % current set point	2000 .. 32000	µs	2000	U16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
				100% 电流设定值的坡道时间					
0x26	2026	Iq -Cmd	Status 状态	Current Command value 电流指令值	See section 10.4 on page 244 见第 189 页第 10.4 节	Num	N/A	I16	RO / RO
0x27	2027	Iq actual	Status 状态	Q-current actual Q-电流实际值	See section 10.4 on page 244 见第 189 页第 10.4 节	Num	N/A	I16	RO / RO
0x28	2028	Id actual	Status 状态	D-current actual D-电流实际值	See section 10.4 on page 244 见第 189 页第 10.4 节	Num	N/A	I16	RO / RO
0x29	2029	Vq	Status 状态	Q-Output voltage Q 输出电压	±4095	Num	N/A	I32	RO / RO
0x2A	202A	Vd	Status 状态	D-Output voltage D 输出电压	±4095	Num	N/A	I32	RO / RO
0x2B	202B	I -TiM	Configuration 配置	Limit value for integral component (current controller) 积分分量的限值 (电流控制器)	0 .. 100	%	90	U16	RW / RW
0x2C	202C	N -Kp	Configuration 配置	Proportional amplification speed controller 比例放大速度控制器	0 .. 200	Num	10	U16	RW / RW
0x2D	202D	N -Ti	Configuration 配置	Integral action time (Integral part) speed controller 积分动作 时间 (积分部分) 速度控制器	0 .. 10000 (0 = off)	ms	6	U16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
0x2E	202E	N -Td	Configuration 配置	Advancing-time (Differential part) speed controller 超前（微分部分）速度控制器	0 .. 65535 (0 = off)	1/ms	0	U16	RW / RW
0x30	2030	N -Actual	Status 状态	Speed actual value 速度实际值	±32767	Num	N/A	I16	RO / RO
0x31	2031	N -Set(dig)	Set-point 设定值	Digital Speed Set Point 数字速度设定值	±32767	Num	N/A	I16	RW / RWW
0x32	2032	N -Cmd Ramp	Status 状态	Speed command value after Ramp 坡道后的速度指令值	±32767	Num	N/A	I16	RO / RO
0x33	2033	N -Error	Status 状态	Speed setpoint minus actual speed in numeric 速度设定值减去数字形式的实际速度	±32767	Num	N/A	I16	RO / RO
0x34	2034	N-Limit	Configuration 配置	Global speed limit 全局限速	±32767	Num	32767 (100%)	I16	RW / RWW
0x35H	2035	Accel.	Configuration 配置	Torque command acceleration value 扭矩指令加速度值	1 .. 10000	ms	0x0001 (1 ms)	U32	RW / RW
0x35L	2035	Accel.	Configuration 配置	Speed command acceleration value 速度指令加速度值	1 .. 32000	ms	0x012c (300 ms)	U32	RW / RW
0x38	2038	Iq error	Status 状态	Q-current error feedback (active current)Q 电流误差反馈（有功电流）	±32767	Num	N/A	I16	RO / RO
0x39	2039	Id error	Status 状态	D-current error feedback (reactive current)D-电流误差反馈（无功电流）	±32767	Num	N/A	I16	RO / RO

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
0x3B	203B	N -TiM	Configuration 配置	Limit value for integral component (speed controller) 积分分量的限值（速度控制器）	0 .. 100 0 = off	%	10	U16	RO / RW
0x3C	203C	I-red-N	Configuration 配置	Speed when current reduction starts 电流降低开始时的速度	0 .. 32767	Num	0	U16	RO / RW
0x3D	None	READ	Function 功能	Read a specific register, and at the same time it is possible to configure the IMD to auto report through CAN a specific parameter value at the configured auto report interval. Maximum eight registers can be configured to auto report. 读取特定寄存器，同时可以在配置的自动报告间隔内通过 CAN 特定参数值将 IMD 配置为自动报告。最多可配置八个寄存器以自动报告。	Low byte: register to read High byte: auto-report cycle time in ms. 0 disables auto-read, 255 returns the active auto-read object index for this register. 低字节：寄存器读取 高字节：以毫秒为单位的自动报告周期时间。0 禁用自动读取，255 返回此寄存器的激活自动读取对象索引。	Num	N/A	N/A	RW / RW
0x3E	203E	N-lim -	Configuration 配置	Negative speed limit. Needs to enabled in 0x51 (bit 6). 负速度限制。 需要在 0x51 中启用（位 6）。	-32768 .. 0	Num	-32768 (100%)	I16	RW / RW
0x3F	203F	N-lim +	Configuration 配置	Positive speed limit. Needs to enabled in 0x51 (bit 6).	0 .. 32767	Num	32767 (100%)	I16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
				正速度限制。 需要在 0x51 中启用（位 6）。					
0x40	2040	State Bits	Status 状态	State Bits; see section 13.2.4 on page 269 状态位；见第 206 页第 13.2.4 节	Binary bit mapping 二进制位映射	N/A	N/A	U32	RO / RO
0x42	2042	MPOS_Actual_Mech	Status 状态	Actual rotor position 实际转子位置	±32767	Num	N/A	I16	RO / RO
0x43	2043	MPOS_Actual_Elec	Status 状态	Actual rotor position within one electrical phase 一个电气相位内的实际转子位置	±32767	Num	N/A	I16	RO / RO
0x44	2044	Resolver Offset	Configuration 配置	Resolver phase angle correction 编码器相位角校正	±3600	0.1 degree	0	I16	RW / RW
0x45 L	2045 L	Monitor_ballast	Status 状态	Ballast energy counter 镇流器能量计数器	0 .. 1000	Num	N/A	I32	RO / N/A
0x45 H	2045 H	Monitor_IxT	Status 状态	Current overload integral 电流过载积分	0 .. 100	Num	N/A	I32	RO / RO
0x46	2046	I-Lim-Dig	Configuration 配置	Value in percent for the digital current reduction (enables in 0x51, bit 5) 数字电流减少的百分比值（在 0x51 第 5 位启用）	327 .. 32767 (1 .. 100%)	Num	32767 (100%)	U16	RW / RW
0x47 L	2047 L	VLMS-low	Configuration 配置	Number of revolutions for the low virtual limit switch. Value of zero in reg 2047 disables virtual limit switches.	0 .. 32767	Revo- lution	0	I32	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
				低虚拟限位开关的转数。 reg 2047 中的值为零将禁用虚拟限位开关。					
0x47 H	2047 H	VLMS-high	Configuration 配置	Number of revolutions for the high virtual limit switch. Value of zero in reg 2047 disables virtual limit switches. 高虚拟限位开关的转数。 reg 2047 中的值为零将禁用虚拟限位开关。	0 .. 32767	Revo- lution	0	I32	RW / RW
0x48	2048	I-Lim_inuse	Status 状态	Actual used current limit. 实际使用的电流限制。	See section 10.4 on page 244 . 见第 189 页第 10.4 节。	Num	N/A	I16	RO / RO
0x49	2049	T-Motor	Status 状态	Motor temperature. See also section 10.3.2 on page 229 (KTY 84) and section 10.3.3 on page 233 (Pt100).. 电机温度。另请参阅第 176 页 (KTY 84) 的 10.3.2 节和第 180 页 (Pt100) 的 10.3.3 节。	0 .. 65535	Num	N/A	U16	RO / RO
0x4A	204A	T-IGBT	Status 状态	IGBT module temperature. See also section 10.3.1 on page 227 . IGBT 模块温度。另请参阅第 174 页上的第 10.3.1 节。	0 .. 65535	Num	N/A	U16	RO / RO
0x4B	204B	T-Air	Status 状态	Air temperature in the servo. See also section 10.3.5 on	0 .. 65535	Num	N/A	U16	RO / RO

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
				page 241 . 伺服系统中的空气温度。另见第 186 页第 10.3.5 节。					
0x4C	204C	I-red-TE	Configuration 配置	See section 8.5.3 on page 148 . 请参阅第 113 页上的第 8.5.3 节。	0 .. 32767 0 = off.	Num	0	U16	RW / RW
0x4D	204D	I -Motor max	Configuration 配置	Peak current limiting for the motor (motor type plate value) 电机的峰值电流限制（电机类型铭牌值）	1 .. 65535	0.1 A _{rms}	1200 (120 A)	U16	RW / RW
0x4E	204E	I -Motor con	Configuration 配置	Continuous current rating for the motor (motor type plate value) 电机的持续额定电流（电机类型铭牌值）	1 .. 65535	0.1 A _{rms}	600 (60A)	U16	RW / RW
0x4F	204F	Motor Pole	Configuration 配置	No. of motor poles 电机极数	2 .. 96	Num	8	U16	RW / RW
0x51	2051	Mode Bit	Special 特殊	Mode bits; see bit mapping in section 13.2.5 on page 272 模式位；见第 208 页第 13.2.5 节中的位映射	Binary bit mapping 二进制位映射	N/A	0x0004	U16	RW / RW
0x52	2052	STATUS_Mask	Special 特殊	Proprietary CAN only: Bitmask for register 0x40 transmission on update. 仅限专有 CAN: 更新时寄存器 0x40 传输的位掩码。	Binary bit mapping 二进制位映射	N/A	0x0000f811	U32	RO / RW
0x54	2054	I1_actual	Status	Actual current value phase 1 相位 1 的实际电流值	See section 10.4 on page 244 . 见第 189 页第	Num	N/A	I16	RO / RO

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
					10.4 节。				
0x55	2055	I2_actual	Status 状态	Actual current value phase 2 相位 2 的实际电流值	See section 10.4 on page 244 . 见第 189 页第 10.4 节。	Num	N/A	I16	RO / RO
0x56	2056	I3_actual	Status 状态	Actual current value phase 3 相位 3 的实际电流值	See section 10.4 on page 244 . 见第 189 页第 10.4 节。	Num	N/A	I16	RO / RO
0x58	2058	I-red-TD	Configuration 配置	See section 8.5.3 on page 148 . 见第 113 页第 8.5.3 节。	0 .. 32767 0 = off	Num	0	U16	RW / RW
0x59	2059	N –Motor nom	Configuration 配置	Rated motor speed according to motor type plate	60 .. 65000	RPM	3000	U16	RW / RW
0x5A	205A	Option bit	Configuration 配置	Option bit; see section 13.2.6 on page 273 根据电机类型铭牌确定的额定 电机转速 选项位；见第 209 页第 13.2.6 节	Binary bit mapping 二进制位映射	N/A	0x00044096	U32	RW / RO
0x5B	205B	Kacc	Configuration 配置	Acceleration amplification (feed forward). 加速度放大(前馈)。	0 .. 100	%	0	U16	RW / RW
0x5D	205D	N cmd (int)	Status	Speed command value before ramp 坡道前的速度指令值	±32767	Num	N/A	I16	RO / RO
0x5E	205E	N -Filter	Configuration 配置	Speed actual value filter: Averaging level of resolver input	0 .. 15	Num	1	U16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
				速度实际值滤波器：编码器输入的平均水平					
0x5F	205F	I act (filt)	Status 状态	Filtered, actual current value for display in IMD Manager 在 IMD 监控软件中显示的已过滤实际电流值	±32767	Num	N/A	I16	RO / RO
0x61	2061	VDC_BAT_MID	Status 状态	Battery mid-point voltage (SEM terminal) 电池中点电压（SEM 端子）	0 .. 32768 See section 10.2 on page 227 见第 174 页第 10.2 节	Num	N/A	U16	RO / RO
0x62	2062	SNr.	Configuration 配置	IMD serial number / DEIF order no. IMD 序列号 / DEIF 订单号	0 .. 4294967295	Num	N/A	U32	RO / RO
0x63	2063	Power board status	Status 状态	Power boards status 电源板状态	0 .. 65535	Num	N/A	U16	RO / RO
0x64	2064	Device mains	Configuration 配置	Device nominal voltage. 设备标称电压。	N/A	N/A	400	U16	RW / RW
0x65L	2065L	Ballast P	Configuration 配置	Regenerative Resistor – Power rating 再生电阻-额定功率	25 .. 5000	W	0x012c (300 W)	U32	RW / RW
0x65H	2065H	Ballast R	Configuration 配置	Regenerative Resistor – Resistance value 再生电阻 - 电阻值	8 .. 100 (maximum 40 Ω recommended)建议最大值为 40 Ω	Ω	0x0014 (20 Ω)	U32	RW / RW
0x66	2066	Vdc Bat	Status 状态	Filtered battery voltage (“SE+” terminal)	0 .. 32768 See section 10.2	Num	N/A	U16	RO / RO

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
				过滤后的电池电压（“SE+”端子）	on page 227 见第 174 页第 10.2 节				
0x67	2067	Device type	Configuration 配置	Device type 设备类型	Low byte value: 低字节值 66: IMD 122A 67: IMD 122 B 70: IMD 122 C 71: IMD 135 C	Num	Value of the device type 设备类型的值	U32	RO / RO
0x68	2068	CAN Rx ID	Configuration 配置	CAN Receive address / CANopen Node ID CAN 接收地址/CANopen 节点 ID	See CAN/CANopen section 7.1 on page 84 见第 66 页 CAN/CANopen 第 7.1 节	COB- ID	513	U32	RW / RW
0x69	NONE	CAN Tx ID	Configuration 配置	CAN Transmit address / (Not used in CANopen) CAN 传输地址/（在 CANopen 中未使用）	See CAN/CANopen section 7.1 on page 84 见第 66 页 CAN/CANopen 第 7.1 节	COB- ID	385	U32	RW / RW
0x6A	206A	POS_Kp	Configuration 配置	Position to Speed Proportional amplification 位置速度比例放大	0 .. 500	Num	20	U16	RW / RW
0x6B	206B	POS_Ti	Configuration 配置	Integral action time (Integral part) position controller P-N	0 .. 10000	ms	0	U16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
				积分动作时间（积分部分）位置控制器 P-N					
0x6C	206C	POS_KD	Configuration 配置	Advancing-time (differential part) position controller 超前（微分部分）位置控制器	30 to 2000	Num	N/A	U16	RW / RW
0x6D	206D	POS -Actual	Status	Actual position 实际位置	± 2147483647	Num	N/A	I32	RO / RO
0x6E	206E	POS_Dest	Set-point	Position target command 定位目标命令	± 2147483647	Num	N/A	I32	RW / RWW
0x6F	206F	POS_Actual_2	Status 状态	Actual position from SSI encoder SSI 编码器的实际位置	± 2147483647	Num	N/A	I32	RO / RO
0x70	2070	POS -Error	Status 状态	Position actual error 位置实际误差	± 2147483647	Num	N/A	I32	RO / RO
0x71	2071	POS-TiM	Configuration 配置	Position to Speed Max integration time memory 最大速度积分时间存储器的位置	0 .. 100	%	0	U16	RW / RW
0x73	NONE	CAN_BTR	Configuration 配置	CAN Bus Transfer Rate CAN 总线传输速率	See CAN/CANopen section 7.1 on page 84 见第 66 页 CAN/CANopen 第 7.1 节	Hex	0x21f4 (500 kbps, for CANopen)	U16	RW / RW
0x76 L	2076 L	N-safety run speed	Configuration 配置	Safety run speed 安全运行速度	0 .. 32767	Num	0x08ec (7 % of Nmax-100%)	I32	RW / RW
0x76 H	2076 H	N-safety run timeout	Configuration	Safety run timeout	0 .. 70	S	0x0032 (50 s)	I32	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
			配置	安全运行超时					
0x77 L	2077 L	N-blind safety run speed	Configuration 配置	Used for blind safety run and resolver offset calibration speed 用于盲安全运行和编码器偏移校准速度	0 .. 32767	Num	0x0 (0 % of Nmax-100%)	I32	RW / RW
0x77 H	2077 H	N-blind safety run timeout	Configuration 配置	Used for blind safety run and resolver offset calibration timeout 用于盲安全运行和编码器偏移校准超时	0 .. 350	S	0x0096 (150 s)	I32	RW / RW
0x78	2078	Fun_safety run	Function 功能	Initiate or resume safety run 启动或恢复安全运行	0 .. 65535	Num	N/A	U16	WO / WO
0x79	2079	POS_Tol_window	Configuration 配置	Tolerance window for position 位置公差窗口	0 .. 32767	Num	8191	U16	RW / RW
0x7A	207A	POS_Preset	Set point	Used together with position preset function. Value in this register will be used as number of rounds. 与位置预设功能一起使用。此寄存器中的值将用作转数。	± 2147483647	Num	N/A	I32	RW / RW
0x7C	207C	Userinfo_Pos_Scale	Configuration 配置	Display-conversion scale 显示转换比例	± 2147483647	Num	0	I32	RW / RW
0x7D	207D	Userinfo_Pos_Offset	Configuration 配置	Display-conversion offset 显示转换偏移量	± 2147483647	Num	0	I32	RW / RW
0x81 L	2081 L	SE_warn_level	Configuration 配置	Warning level for low SE voltage 低 SE 电压的警告级别	0 .. 32767	Num	12288 (≈206 V)	U32	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
0x81 H	2081 H	DClink_low_level	Configuration 配置	Error level for low DC-link voltage 低直流母线电压的错误等级	0..32767	Num	8192 (≈137 V)	U32	RW / RW
0x82	2082	Serial_number_extension	Configuration 配置	Device serial number ext. / DEIF order position no. and counter 设备序列号 ext./DEIF 订单位置号和计数器	0 .. 4294967295	Num	N/A	U32	RO / RO
0x83	2083	FUN_ParaRead	Function 功能	Read parameter-set x from Eeprom into RAM 将参数集 x 从 Eeprom 读入 RAM	0 .. 2	Num	N/A	U16	WO / WO
0x84	2084	FUN_ParaWrite	Function 功能	Write parameter-set x from RAM into Eeprom 将参数集 x 从 RAM 写入 Eeprom	0 .. 1	Num	N/A	U16	WO / WO
0x85	NONE	FUN_Special	Function 功能	Used for special function select and feedback 用于特殊功能选择和反馈	N/A	Num	N/A	U16	RW
0x8A	208A	V-out	Status 状态	Relative output voltage 相对输出电压	0 .. 4095	Num	N/A	I16	RO / RO
0x8B	208B	V-red	Configuration 配置	Begin of field weakening in percentage of VOUT. 0 or 100 disables field weakening. 开始磁场减弱，以 VOUT 的百分比表示。0 或 100 禁用磁场减弱。	0 .. 100	%	0	I16	RW / RWR
0x8C	208C	V-kp	Configuration 配置	Proportional amplification field reduction 比例放大场减弱	0 .. 65535	Num	1000	U16	RW / RW
0x8D	None	V-ti	Configuration	Integral amplification field	0 .. 65535	Num	0	U16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
			配置	reduction 积分放大场减弱					
0x8E	208E	FUN_ErrCancel	Function 功能	Initiate clear error 启动清除错误	0 .. 65535	Num	N/A	U16	WO / WO
0x8F	208F	Errors_Warnings map	Status 状态	Error bits (0 - 15), and Warning bits (16 - 31), see section 13.2.7 on page 275 错误位（0-15）和警告位（16-31），见第 210 页第 13.2.7 节	Binary bit mapping	N/A	N/A	U32	RO / RO
0x90	2090	M set	Set-point 设定点	Torque Set Point (based on the current). 15 bit (+/-) corresponds to 150 % of Device design current. 扭矩设定点（基于电流）。15 位 (+/-) 对应于器件设计电流的 150%。	±32767	Num	N/A	I16	RW / RWW
0x91	2091	Pos cmd	Status 状态	Position Command value (int.) 位置命令值 (int.)	± 2147483647	Num	N/A	I32	RO / RO
0x92	NONE	CAN_Error_BusOff	Status 状态	CAN proprietary: CAN bus off error counter CAN 专有: CAN 总线关闭错误计数器	0 .. 65535	Num	N/A	U16	RO / RO
0x93	NONE	CAN_ErrWriteTime	Status 状态	CAN proprietary: CAN bus framing error counter CAN 专有: CAN 总线帧错误计数器	0 .. 65535	Num	N/A	U16	RO / RO
0x94	2094	Power_board_error_	Status	First error (code) on power	0 .. 65535	Num	N/A	U16	RO / RO

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
		1	状态	board since last clear error command. 自上次清除错误命令以来电源板上的第一个错误（代码）。					
0x95	NONE	CAN_CountRead	Status 状态	CAN proprietary: CAN bus acknowledge error counter CAN 专有：CAN 总线确认错误计数器	0 .. 65535	Num	N/A	U16	RO / RO
0x96	NONE	CAN_CountWrite	Status 状态	CAN proprietary: CAN bus CRC error counter CAN 专有：CAN 总线 CRC 错误计数器	0 .. 65535	Num	N/A	U16	RO / RO
0x97	NONE	CAN_CountRej	Status 状态	CAN proprietary: CAN bus bit error counter CAN 专有：CAN 总线位错误计数器	0 .. 65535	Num	N/A	U16	RO / RO
0x98	2098	LOGIC_O_Block	Special 特殊	Digital outputs see bit mapping in section 13.2.8 on page 276 数字输出见第 211 页第 13.2.8 节中的位映射	Binary bit mapping 二进制位映射	N/A	0x0080	U16	RW / RWW
0x9B	209B	LOGIC_I_Block	Status 状态	Digital inputs see bit mapping in section 13.2.9 on page 277 数字输入 see 位映射在 212 页 13.2.9 节	Binary bit mapping 二进制位映射	N/A	N/A	U32	RO / RO
0x9C	209C	T_Pt100_1	Status 状态	Pt 100 input 1 value. See also temperature conversion in section 10.3.4 on page 237 . Pt 100 输入 1 值。另请参阅第	0 .. 4095	Num	N/A	I16	RO / RO

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
				183 页上的 10.3.4 节中的温度转换。					
0x9D	209D	T_Pt100_2	Status 状态	Pt 100 input 2 value. See also temperature conversion in section 10.3.4 on page 237 . Pt 100 输入 2 值。另请参阅第 183 页上的 10.3.4 节中的温度转换。	0 .. 4095	Num	N/A	I16	RO / RO
0x9E	209E	T_Pt100_3	Status 状态	Pt 100 input 3 value. See also temperature conversion in section 10.3.4 on page 237 . Pt 100 输入 3 值。另请参阅第 183 页上的 10.3.4 节中的温度转换。	0 .. 4095	Num	N/A	I16	RO / RO
0x9F	209F	T_Pt100_4	Status 状态	Pt 100 input 4 value. See also temperature conversion in section 10.3.4 on page 237 . Pt 100 输入 4 值。另请参阅第 183 页上的 10.3.4 节中的温度转换。	0 .. 4095	Num	N/A	I16	RO / RO
0xA0	20A0	M actual	Status 状态	Torque actual (based on the current). 15 bit (+/-) corresponds to 150 % of Device design current. 实际扭矩（基于电流）。15 位 (+/-) 对应于器件设计电流的 150%。	±32767	Num	N/A	I16	RO / RO
0xA2	20A2	I-red-TM	Configuration 配置	Motor temperature threshold for current reduction 电流降低的电机温度阈值	0 .. 32767	Num	5600	U16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
0xA3	20A3	M-Temp	Configuration 配置	Motor temperature error is generated and safety run is initiated. Warning is generated at 87.5% of this value. 产生电机温度错误并启动安全运行。警告在该值的 87.5% 时生成。	0 .. 32767	Num	23000	U16	RW / RW
0xA4	20A4	MOTOR_Options	Configuration 配置	Se bit mapping in section 13.2.10 on page 279 第 213 页第 13.2.10 节中的 Se 位映射	Binary bit mapping 二进制位映射	N/A	0x2081	I16	RW / RW
0xA5H	20A5	DC-Bus Vmax	Configuration 配置	Maximum DC-Bus voltage (High part of a 32 bits register). 最大直流母线电压 (32 位寄存器的高部分)	0 .. 32767	Num	0xb850 (789 V)	U32	RW / RW
0xA5L	20A5	DC-Bus VVmin	Configuration 配置	Minimum DC-Bus voltage. (Low part of a 32 bits register). 32767 corresponds to 200% 最小直流母线电压。(32 位寄存器的低部分)。	0 .. 32767	Num	0x4000 (274 V)	U32	RW / RW
0xA7	20A7	Resol. poles	Configuration 配置	No. of resolver poles 编码器极数	2 .. 12	Num	2	U16	RW / RW
0xA8	20A8	N act (filt)	Status	Actual speed value (filtered) 实际速度值 (过滤后)	±32767	Num	N/A	I16	RO / RO
0xAC	20AC	PWM1	Status 状态	Pulse width modulation phase 1 脉宽调制相位 1	4 kHz: 1560 ±1540 8 kHz: 780 ±760	Num	N/A	I16	RO / RO

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
					12 kHz: 1520 ± 1520				
0xAD	20AD	PWM2	Status 状态	Pulse width modulation phase 2 脉宽调制相位 2	4 kHz: 1560 ±1540 8 kHz: 780 ±760 12 kHz: 1520 ± 1520	Num	N/A	I16	RO / RO
0xAE	20AE	PWM3	Status 状态	Pulse width modulation phase 3 脉宽调制相位 3	4 kHz: 1560 ±1540 8 kHz: 780 ±760 12 kHz: 1520 ± 1520	Num	N/A	I16	RO / RO
0xB1	20B1	MOTOR_LSig_Q	Configuration 配置	Motor stator leakage inductance 电机定子漏感	0 .. 4294967295	mH	0	U32	RW / RW
0xB2	20B2	Id nom	Configuration 配置	Nominal magnetising current 标称励磁电流	EC servo EC 伺服: ±200 Asynch.异步: 0 .. 500	Num	0	I16	RW / RW
0xB3	20B3	MOTOR_Magn_L	Configuration 配置	Motor magnetising inductance (ASM) 电机磁化电感 (ASM)	0 .. 4294967295	mH	123	U32	RW / RW
0xB4	20B4	MOTOR_Rotor_R	Configuration 配置	Rotor resistance 转子电阻	0 .. 4294967295	mΩ	0	U32	RW / RW
0xB5	20B5	Id min	Configuration 配置	Minimum magnetising current 最小磁化电流	EC servo EC 伺服: -1000 .. 0	Num	-20	I16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
					Asynch.异步: 0 .. Id nom (0xB2)				
0xB6	20B6	MOTOR_TR	Configuration 配置	Time constant rotor 时间常数转子	0 .. 4294967295	ms	2000	U32	RW / RW
0xBB	20BB	MOTOR_LSig_D	Configuration 配置	Leakage inductance ph-ph 磁漏电感 ph-ph	0 .. 4294967295	mH	0	U32	RW / RW
0xBC	20BC	MOTOR_Stator_R	Configuration 配置	Stator resistance ph-ph 定子电阻 ph-ph	0 .. 4294967295	mΩ	123	U32	RW / RW
0xBD	20BD	MOTOR_Specs_Inertia	Configuration 配置	Time constant stator 时间常数定子	0 .. 4294967295	ms	0	U32	RW / RW
0xBE	20BE	DEFINE_Logic_End1	Configuration 配置	Configuration of input logic function for Limit S. 1 (configured with IMD Manager) 限制 S.1 的输入逻辑功能配置。 (由 IMD 监控软件配置)	N/A	N/A	32771	U16	RW / RW
0xBF	20BF	DEFINE_Logic_End2	Configuration 配置	Configuration of input logic function for Limit S. 2 (configured with IMD Manager) 限制 S.2 的输入逻辑功能配置。 (由 IMD 监控软件配置)	N/A	N/A	32771	U16	RW / RW
0xC0	20C0	DEFINE_Logic_DI1	Configuration 配置	Configuration of input logic function for Logic1<=DI 1 (configured with IMD Manager) 逻辑 1<=DI 1 的输入逻辑功能配置 (由 IMD 监控软件配置)	N/A	N/A	32768	U16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
0xC1	20C1	DEFINE_Logic_DIn2	Configuration 配置	Configuration of input logic function for Logic2<=DI 2 (configured with IMD Manager) 逻辑 2<=DI 2 的输入逻辑功能配置 (由 IMD 监控软件配置)	N/A	N/A	32768	U16	RW / RW
0xC2	20C2	DEFINE_Logic_DOut 1	Configuration 配置	Configuration of Output logic function for Logic-8<=DO 8 (configured with IMD Manager) 逻辑-8<=DO 8 的输出逻辑功能配置 Logic2<=DI 2 (由 IMD 监控软件配置)	N/A	N/A	43078	U16	RW / RW
0xC3	20C3	DEFINE_Logic_DOut 2	Configuration 配置	Configuration of Output logic function for Logic-7<=DO 7 (configured with IMD Manager) 逻辑-7<=DO 7 的输出逻辑功能配置 (由 IMD 监控软件配置)	N/A	N/A	19	U16	RW / RW
0xC4	20C4	I -Max	Configuration 配置	Current limit, peak current. 100% = 16384 corresponds to 1.5*I device 电流限制, 峰值电流。 100% = 16384 对应 1.5*I 设备	0 .. 32767 (limited by device) (受设备限制)	Num	16383	U16	RW / RWW
0xC5	20C5	I-continuous	Configuration 配置	Current limit, continuous current 100% = 16384 corresponds to I device 电流限制, 持续电流 100% = 16384 对应 I 设备	0 .. I -Device	Num	16383	U16	RW / RWW
0xC6	20C6	I -Device	Configuration 配置	Device design current (60A = 600) 器件设计电流 (60A = 600)	0 .. 65535	0.1 A	600 (60 A)	U16	RO

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
			(受保护) (protected)						
0xC7 L	20C7 L	Fast dec. time	Configuration 配置	Emergency stops time ramp, limit switch for 100 % speed command 紧急停止时间坡道, 100 % 速度指令的限位开关	1 .. 10000	ms	300	U32	RW / RWW
0xC7 H	20C7 H	Blind S-run acc..	Configuration 配置	maximum speed during blind safety run (safety run without resolver feedback). Defined as percent of Nmax-100%. A negative value in this parameter means that the motor will run the other way. 盲安全运行期间的最大速度（无编码器反馈的安全运行）。定义为 Nmax-100% 的百分比。 此参数中的负值表示电机将以另一种方式运行。	1500 .. 25000	ms	2500	U32	RW / RWW
0xC8	20C8	Nmax 100%	Configuration 配置	Maximum RPM for 100% (as Parameter) 100% 的最大 RPM（作为参数）	1 .. 12000	rpm	3000	U16	RW
0xC9	20C9	xKp2	Configuration 配置	Proportional amplification on overshoot current controller 过冲电流控制器的比例放大	0 or 100 .. 500	%	100	U16	RW / RWW
0xCB	20CB	Kf	Configuration 配置	Feedforward amplification current controller 前馈放大电流控制器	0 .. 65535	Num	0	U16	RW / RW
0xD0	20D0	CAN_TimeOut	Configuration	Timeout for the CAN/CANopen	0: No time out 未	ms	0	U16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
			配置	communication CAN/CANopen 通信超时	超时 1 .. 65535				
0xD1	20D1	VAR1	Configuration 配置	Comparison reference value 1 比较参考值 1	± 2147483647	Num	10000	I32	RW / RW
0xD2	20D2	VAR2	Configuration 配置	Comparison reference value 2 比较参考值 2	± 2147483647	Num	3	I32	RW / RW
0xD3	20D3	VAR3	Configuration 配置	Comparison reference value 3 比较参考值 3	± 2147483647	Num	10	I32	RW / RW
0xD4	20D4	VAR4	Configuration 配置	Comparison reference value 4 比较参考值 4	± 2147483647	Num	661654959	I32	RW / RW
0xD8	20D8	LOGIC_IO_BitMap	Status 状态	Logic assignment, see bit mapping in section 13.2.11 on page 280 逻辑分配, 请参见第 213 页上的 13.2.11 节中的位映射	Binary bit mapping 二进制位映射	N/A	N/A	U16	RO / RO
0xD9	20D9	Current_200Pc	Status 状态	Calibration value for 200 % nominal current (see 0xc6) 200%标称电流的校准值 (见 0xc6)	0 .. 65535	N/A	N/A	U16	RO / RO
0xDA	20DA	DEFINE_Logic_DOut 3	Configuration 配置	Configuration of Output logic function for Logic-6<=DO 6 (configured with IMD Manager) 逻辑-6<=DO 6 的输出逻辑功能配置 (由 IMD 监控软件配置)	N/A	N/A	58899	U16	RW / RW
0xDB	20DB	DEFINE_Logic_DOut 4	Configuration 配置	Configuration of Output logic function for Logic-5<=DO 5 (configured with IMD Manager)	N/A	N/A	59155	U16	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
				逻辑-5<=DO 5 的输出逻辑功能配置（由 IMD 监控软件配置）					
0xDD	20DD	JOGGING	Configuration 配置	Configuration of manual operation parameters: 手动操作参数的配置:				U32	RW / RW
				Bits 0-11: Speed for manual operation in % of Nmax-100 (max 12%) 位 0-11: 手动操作速度, 以 Nmax-100 的百分比表示 (最大 12%)	0 .. 3932 (0 .. 12%)	Num			
				Bits 12-23 Acceleration ramp for manual operation (given as acceleration from 0 to Nmax-100) 位 12-23 手动操作的加速坡道 (以从 0 到 Nmax-100 的加速度给出)	0 .. 4095	mS			
				Bits 24-28: Max motor operation time 位 24-28: 最大电机运行时间	0 .. 31	S			
				Bits 29-31: Brake delay after operation 位 29-31: 操作后的制动延迟	0 .. 7	S			
0xDE	20DE	Logic-6	Status 状态	See section 6.2 on page 76 请参阅第 61 页上的第 6.2 节	0 .. 1	Num	N/A	U16	RO / RO
0xDF	20DF	Logic-5	Status 状态	See section 6.2 on page 76 请参阅第 61 页上的第 6.2 节	0 .. 1	Num	N/A	U16	RO / RO

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
0xE0	20E0	Logic-8	Status 状态	See section 6.2 on page 76 请参阅第 61 页上的第 6.2 节	0 .. 1	Num	N/A	U16	RO / RO
0xE1	20E1	Logic-7	Status 状态	See section 6.2 on page 76 请参阅第 61 页上的第 6.2 节	0 .. 1	Num	N/A	U16	RO / RO
0xE2	20E2	SCR 1 and 2	Status 状态	See section 6.2 on page 76 请参阅第 61 页上的第 6.2 节	0 .. 1	Num	N/A	U16	RO / RO
0xE3	20E3	O_Go	Status 状态	See section 6.2 on page 76 请参阅第 61 页上的第 6.2 节	0 .. 1	Num	N/A	U16	RO / RO
0xE4 L	20E4	SPEED_CALIB_EXT RA_C (FW>1.08.9)	Configuration 配置	Definition of safety run profile step 5. See section 8.5.2 on page 140 for safety run profile description. 安全运行配置文件第 5 步的定义。有关安全运行配置文件说明，请参见第 106 页上的第 8.5.2 节。	Bit 0-10: position Bit 11-15: speed 位 0-10: 位置 位 11-15: 速度	Pos: 1 rev. Speed: 5%	N/A	I32	RW / RW
0xE4 H	20E4	SPEED_CALIB_EXT RA_C (FW>1.08.9)	Configuration 配置	Definition of safety run profile step 6. See section 8.5.2 on page 140 for safety run profile description. 安全运行配置文件第 6 步的定义。有关安全运行配置文件说明，请参见第 106 页上的第 8.5.2 节。	Bit 16-26: position Bit 27-31: speed 位 16-26: 位置 位 27-31: 速度	Pos: 1 rev. Speed: 5%	N/A	I32	RW / RW
0xE5 L	20E5	SPEED_CALIB_EXT RA_D (FW>1.08.9)	Configuration 配置	Definition of safety run profile step 7. See section 8.5.2 on page 140 for safety run profile description.	Bit 0-10: position Bit 11-15: speed 位 0-10: 位置	Pos: 1 rev. Speed:	N/A	I32	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
				安全运行配置文件第 7 步的定义。有关安全运行配置文件说明，请参见第 106 页上的第 8.5.2 节。	位 11-15: 速度	5%			
0xE5 H	20E5	SPEED_CALIB_EXT RA_D (FW>1.08.9)	Configuration 配置	Definition of safety run profile step 8. See section 8.5.2 on page 140 for safety run profile description. 安全运行配置文件第 8 步的定义。有关安全运行配置文件说明，请参见第 106 页上的第 8.5.2 节。	Bit 16-26: position Bit 27-31: speed 位 16-26: 位置 位 27-31: 速度	Pos: 1 rev. Speed: 5%	N/A	I32	RW / RW
0xE6 L	20E6	SPEED_CALIB_EXT RA_E (FW>1.08.9)	Configuration 配置	Definition of safety run profile step 9. See section 8.5.2 on page 140 for safety run profile description. 安全运行配置文件第 9 步的定义。有关安全运行配置文件说明，请参见第 106 页上的第 8.5.2 节。	Bit 0-10: position Bit 11-15: speed 位 0-10: 位置 位 11-15: 速度	Pos: 1 rev. Speed: 5%	N/A	I32	RW / RW
0xE6 H	20E6	SPEED_CALIB_EXT RA_E (FW>1.08.9)	Configuration 配置	Definition of safety run profile step 10. See section 8.5.2 on page 140 for safety run profile description. 安全运行配置文件第 10 步的定义。有关安全运行配置文件说明，请参见第 106 页上的第 8.5.2 节。	Bit 16-26: position Bit 27-31: speed 位 16-26: 位置 位 27-31: 速度	Pos: 1 rev. Speed: 5%	N/A	I32	RW / RW
0xE7 L	20E7	SPEED_CALIB_EXT RA_F	Configuration 配置	Definition of safety run profile step 11. See section 8.5.2 on	Bit 0-10: position Bit 11-15: speed	Pos: 1 rev.	N/A	I32	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
		(FW>1.08.9)		page 140 for safety run profile description. 安全运行配置文件第 11 步的定义。有关安全运行配置文件说明，请参见第 106 页上的第 8.5.2 节。	位 0-10: 位置 位 11-15: 速度	Speed: 5%			
0xE7 H	20E7	SPEED_CALIB_EXT RA_F (FW>1.08.9)	Configuration 配置	Definition of safety run profile step 12. See section 8.5.2 on page 140 for safety run profile description. 安全运行配置文件第 12 步的定义。有关安全运行配置文件说明，请参见第 106 页上的第 8.5.2 节。	Bit 16-26: position Bit 27-31: speed 位 16-26: 位置 位 27-31: 速度	Pos: 1 rev. Speed: 5%	N/A	I32	RW / RW
0xE8	20E8	LOGIC_I_RUN	Status 状态	See section 6.2 on page 76 请参阅第 61 页上的第 6.2 节	0 .. 1	Num	N/A	U16	RO / RO
0xE9	20E9	LOGIC_I_Fault	Status 状态	See section 6.2 on page 76 请参阅第 61 页上的第 6.2 节	0 .. 1	Num	N/A	U16	RO / RO
0xEA	20EA	LOGIC_I_Ballast	Status 状态	See section 6.2 on page 76 请参阅第 61 页上的第 6.2 节	0 .. 1	Num	N/A	U16	RO / RO
0xEB	20EB	V -DCBus	Status 状态	DC-link voltage 直流母线电压	0 .. 32767	Num	N/A	U16	RO / RO
0xEC	20EC	LOGIC_I_Los	Status 状态	Resolver signal missing or faulty (2 bits) 编码器信号缺失或故障 (2 位)	0: OK 正常 1: Resolver decoder error 编码器解码器错误 2: HW detected loss of signal	Num	N/A	U16	RO / RO

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
					(LoS)硬件检测到信号丢失 (LoS) 3: Both faults detected 检测到两个故障				
0xED L	20ED L	Dec_time_torque	Configuration 配置	Deceleration time for torque control 扭矩控制的减速时间	1 .. 32000	ms	300	U32	RW / RWW
0xED H	20ED H	Dec_time_speed	Configuration 配置	Deceleration time for speed control 速度控制的减速时间	1 .. 10000	ms	1	U32	RW / RWW
0xEE	20EE	I -100Pct	Configuration 配置	Current sensor adjustment 电流传感器调整	50 .. 2000	mV	842	U16	RO / RO
0xEF	20EF	LOGIC_O_NoFault	Status 状态	No fault output 无故障输出	0 .. 1	Num	N/A	U16	RO / RO
0xF0	20F0	TIME_IPeak	Configuration 配置	Over-current time. See also I max extended (0x01) 过电流时间。另见 I 最大扩展 (0x01)	1 .. 6	s	5	U16	RW / RW
0xF1	20F1	Brake delay	Configuration 配置	Response time motor brake 电机制动器的响应时间	1 .. 1000	ms	250	U32	RW / RW
0xF2	20F2	Brake output	Status 状态	Brake delay time is active (1 while the delay is on) 制动器延迟时间激活 (延迟开启时为 1)	0 .. 1	Num	N/A	U16	RO / RO
0xF3	20F3	LOGIC_VO_Icns	Status	Current reduced to configured continuous current	0 .. 1	Num	N/A	U16	RO / RO

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
			状态	电流降低至配置连续电流					
0xF4	20F4	LOGIC_VO_Toler	Status 状态	Position is within tolerance window 位置在公差窗口内	0 .. 1	Num	N/A	U16	RO / RO
0xF5	20F5	LOGIC_VO_Less_N0	Status 状态	Speed is almost zero 速度几乎为零	0 .. 1	Num	N/A	U16	RO / RO
0xF6	20F6	PowerOut	Status 状态	Calculated power in use 使用中的计算功率	0 .. 65535	Num	N/A	U16	RO / RO
0xF7	20F7	WorkOut	Status 状态	Calculated work (accumulated power over time). After FFFF it starts with zero again. 计算功（随时间累积的功率）。在 FFFF 之后，它再次从零开始。	0 .. 65535	Num	N/A	U16	RO / RO
0xF8	20F8	Axis label	Configuration 配置	Axis Label, 4 ASCII characters 轴标签，4 个 ASCII 字符	Bit 0 -7: first character Bit 8 .. 15: second character Bit 16 .. 23: third character Bit 24 .. 31: forth character 位 0 -7: 第一个字符 位 8 .. 15: 第二个字符 位 16 .. 23: 第三个字符 位 24 .. 31: 第四	Binary	0	U32	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
					个字符				
0xFB L	20FB L	SPEED_CALIB_EXT RA_A (FW≥1.03.6)	Configuration 配置	Definition of safety run profile step 1. See section 8.5.2 on page 140 for safety run profile description. 安全运行配置文件第 1 步的定义。有关安全运行配置文件的说明，请参见第 106 页上的第 8.5.2 节。	Bit 0-10: position Bit 11-15: speed 位 0-10: 位置 位 11-15: 速度	Pos: 1 rev. Speed: 5%	N/A	U32	RW / RW
0xFB H	20FB H	SPEED_CALIB_EXT RA_A (FW≥1.03.6)	Configuration 配置	Definition of safety run profile step 2. See section 8.5.2 on page 140 for safety run profile description. 安全运行配置文件第 2 步的定义。有关安全运行配置文件的说明，请参见第 106 页上的第 8.5.2 节。	Bit 16-26: position Bit 27-31: speed 位 16-26: 位置 位 27-31: 速度	Pos: 1 rev. Speed: 5%	N/A	U32	RW / RW
0xFC L	20FC L	SPEED_CALIB_EXT RA_B (FW≥1.03.6)	Configuration 配置	Definition of safety run profile step 3. See section 8.5.2 on page 140 for safety run profile description. 安全运行配置文件第 3 步的定义有关安全运行配置文件的说明，请参见第 106 页上的第 8.5.2 节。	Bit 0-10: position Bit 11-15: speed 位 0-10: 位置 位 11-15: 速度	Pos: 1 rev. Speed: 5%	N/A	U32	RW / RW
0xFC H	20FC H	SPEED_CALIB_EXT RA_B (FW≥1.03.6)	Configuration 配置	Definition of safety run profile step 4. See section 8.5.2 on page 140 for safety run profile description.	Bit 16-26: position Bit 27-31: speed 位 16-26: 位置	Pos: 1 rev. Speed:	N/A	U32	RW / RW

Reg ID	CAN open object CAN open 对象	Parameter name 参数名称 Ser. / CAN	Type 种类	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问 Mem/CAN
				安全运行配置文件第 4 步的定义有关安全运行配置文件的说明，请参见第 106 页上的第 8.5.2 节。	位 27-31：速度	5%			

13.3.1 Charger parameters 充电器参数



Info

The charger must be in Setup mode (Sub-object 7) to be configured.

信息

充电器必须处于设置模式（子对象 7）才能进行配置。

All charger parameters have the same CANopen object ID: **2811** (for proprietary CAN see section [7.1.2.1](#) on page [87](#)). Sub object is used to identify the different parameters. The following table lists all available parameters:

所有充电器参数都具有相同的 CANopen 对象 ID: **2811**（有关专有 CAN，请参阅第 68 页上的第 7.1.2.1 节）。子对象用于标识不同的参数。下表列出了所有可用参数：

Sub object ID 子对象 ID	Parameter name 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问
1	CHARGE_VOLTAGE_SCALED	Status 状态	Charger actual output voltage 充电器实际输出电压	0 .. 65535	0.1 V	N/A	U16	RO

Sub object ID 子对象 ID	Parameter name 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问
2	CHARGE_CURRENT_SCALED	Status 状态	Charger actual output current 充电器实际输出电流	0 .. 65535	0.01 A	N/A	U16	RO
3	UC_CAP	Status 状态	Ultra-capacitor capacity measurement value 超级电容器容量测量值	0 .. 65535	1 mF	N/A	U16	RO
4	UC_ESR	Status 状态	Ultra-capacitor total resistance measurement value 超级电容器总电阻测量值	0 .. 65535	1 mΩ	N/A	U16	RO
5	MON_STATE	Status 状态	Actual state of the charger. Note: When the charger is in state zero when in setup mode. 充电器的实际状态。 注意：当充电器处于设置模式时处于零状态。	0: Disabled (Initialise) 1: Disabled (Off) 2: Disabled (idle) 3: Disabled (ready) 4: Charging (bulk) 5: Charging (absorption) 6: Charging (float) 7: SE test 8: Disabled (error) 0:禁用(初始化) 1:禁用(关闭) 2:禁用(闲置) 3:禁用(就绪) 4:充电(bulk) 5:充电(吸收) 6:充电(浮动) 7: SE 测试 8:禁用(错误)	N/A	N/A	U16	RO
6	MON_STAT_TIME	Status	Elapsed present state time.	0 .. 65535	s	N/A	U16	RO

Sub object ID 子对象 ID	Parameter name 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问
		状态	经过的当前状态时间。					
7	SETUP_MODE	Configuration 配置	Sets the charger in and out of Setup mode. 设置充电器进入和退出设置模式。	0x5555: Setup mode Any other value: not in programming mode 0 x5555:设置模式 任何其他值:不在编程模式中	NUM	0	U16	RW
8	BUCONTROL	Configuration 配置	Save and load parameters to / from EEPROM. 在 EEPROM 中保存和加载参数。	0x1111: Save parameters from RAM to EEPROM 0x1113: Load parameters from EEPROM to RAM 0x1111: 将参数从 RAM 保存到 EEPROM 0x1113: 将参数从 EEPROM 加载到 RAM	NUM	0	U16	RW
10	START_STOP	Function 功能	Start and stop charging. When stop is executed, state changes to ready and waits for start command. 开始和停止充电。当执行停止时, 状态变为就绪并等待启动命令。	0: Stop 停止 1: Start 开始	NUM	1	U16	rW
14	VOLTAGE_IMD_SE	Status 状态	SE voltage measurement by the IMD. 通过 IMD 测量的 SE 电压。	0 .. 65535	0.1 V	N/A	U16	RO
15	SE_STORAGE_TYPE	Configuration 配置	Selection of SE storage type. SE 存储类型的选择。	0: None 无 1: Lead acid 铅酸 2: Lithium Ion 锂离子 3: Ultra capacitor 超级电	N/A	0	U16	RW

Sub object ID 子对象 ID	Parameter name 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问
				容				
16	SE_NOM_VOLTAGE	Configuration 配置	The nominal voltage of the SE from which all other voltage limits are derived. SE 的标称电压，所有其他电压限制均由此得出。	0 .. 65535	0.1 V	0	U16	RW
17	SE_MAX_CURRENT	Configuration 配置	Base current from which all other current limits are derived. 从中导出所有其他电流限值的基本电流。	0 .. 65535	0.01 A	0	U16	RW
18	BULKCHARGEENDVOLTAGE	Configuration 配置	End voltage for bulk stage in percentage of SE_NOM_VOLTAGE (Values above 100% can also be used). bulk 阶段的端电压以 SE_NOM_ 电压的百分比表示（也可以使用高于 100% 的值）	0 .. 65535	0.01%	0	U16	RW
19	BULKCHARGECURRENT	Configuration 配置	Bulk stage constant current in percentage SE_MAX_CURRENT. bulk 阶段恒定电流。以 SE_MAX_ 电流的百分比表示。	0 .. 65535	0.01%	0	U16	RW
20	ABSORBCHARGEVOLTAGE	Configuration 配置	Voltage limit in absorption stage in percentage of SE_NOM_VOLTAGE (Values above 100% can also be used). For Lead acid, reaching this limit ends bulk stage and starts absorption stage. 吸收阶段的电压限制，以 SE_NOM_VOLTAGE 的百分比表示（也可以使用高于 100% 的	0 .. 65535	0.01%	0	U16	RW

Sub object ID 子对象 ID	Parameter name 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认值	Data type 数据类型	Access 访问
			值)。对于铅酸，达到此限值事结束 bulk 阶段并开始吸收阶段。					
21	ABSORBCHARGECURRENT	Configuration 配置	Absorption stage constant current in percentage of SE_MAX_CURRENT. 吸收阶段恒定电流以 SE_MAX_ 电流的百分比表示。	0 .. 65535	0.01%	0	U16	RW
22	ABSORBCHARGEENDCURRENT	Configuration 配置	Current limit that ends the absorption stage in percentage of SE_MAX_CURRENT. For Lithium Ion this limit stops float active charging. 结束吸收阶段的电流限值，以 SE_MAX_ 电流的百分比表示。对于锂离子，此限制会停止浮充主动充电。	0 .. 65535	0.01%	0	U16	RW
23	FLOATCHARGEVOLTAGE	Configuration 配置	Voltage limit in float stage in percentage of SE_NOM_VOLTAGE (Values above 100% can also be used). 浮充阶段的电压限值，以 SE_NOM_ 电压的百分比表示（也可以使用高于 100% 的值）。	0 .. 65535	0.01%	0	U16	RW
24	FLOATCHARGECURRENT	Configuration 配置	Current limit for float stage in percentage of SE_MAX_CURRENT. 浮充阶段的电流限值，以 SE_MAX_ 电流的百分比表示。	0 .. 65535	0.01%	0	U16	RW
31	CHARGER_ERROR	Status	Bit mapped register showing	Bit 0: OPENCIRCUIT	N/A	N/A	U16	RO

Sub object ID 子对象 ID	Parameter name 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Factory default 出厂默认 值	Data type 数据类型	Access 访问
		状态	charger errors status. 0: Not active, 1: Set. The status of the error remains until "Clear errors" is sent to the charger. 位映射寄存器显示充电器错误状态。 0:未激活, 1:设置。 错误状态一直保持到“清除错误”被发送到充电器。	Bit 1: SHORTCIRCUIT Bit 2: CHARGERTEMP 位 0: 开路 位 1: 短路 位 2: 充电器温度				
32	CHARGER_WARNING	Status 状态	Bit mapped register showing charger warnings status. 0: Not active, 1: Active. Warning are automatically cleared when they reason for the warning is not present. 位映射寄存器显示充电器警告状态。 0:未激活, 1:激活。 当警告原因不存在时, 警告将自动清除。	Bit 0: BATTEMP Bit 1: TEMPCHANNEL Bit 2: VinLOW Bit 3: Vin-VseLOW Bit 4: LOWCURR.	N/A	N/A	U16	RO

13.3.2 Error history parameters 错误历史参数

The following table lists available parameters for error history. While all data type is either I32 or U32, and the range is a standard range for these types, the actual values have the same range as the register where the data is fetched from. For example 2881[6] which has an I32 data type (range -2147483647 .. +2147483647) will always contain values with the range of 0 .. 32768 because this is the range of the register where the data is fetched from (0x61).

下表列出了错误历史记录的可参数。虽然所有数据类型都是 I32 或 U32, 并且范围是这些类型的标准范围, 但实际值与获取数据的寄存器具有相同的范围。例如 2881[6] 具有 I32 数据类型 (范围-2147483647 .. +2147483647) 将始终包含范围为 0 .. 32768 的值, 因为这是从 (0x61) 获取数据的寄存器范围。

CANopen Object ID CANopen Object ID 对象 ID	Sub object ID 子对象 ID	Parameter name Ser. / CAN 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Data type 数据类型	Access 访问
2881	1	eHist.X-Actual position	Status 状态	Value of Reg. 0x6D at the time the last error occurred 最后一次错误发生时 Reg. 0x6D 的值	±2147483647	Num	I32	RO
2881	2	eHist.X-Actual position SSI	Status 状态	Value of Reg. 0x6F at the time the last error occurred 最后一次错误发生时 Reg. 0x6F 的值	±2147483647	Num	I32	RO
2881	3	eHist.X-1 st error in power board	Status 状态	Value of Reg. 0x94 at the time the last error occurred 最后一次错误发生时 Reg. 0x94 的值	±2147483647	Num	I32	RO
2881	4	eHist.X-lxT & regen.energy	Status 状态	Value of Reg. 0x45 at the time the last error occurred 最后一次错误发生时 Reg. 0x45 的值	±2147483647	Num	I32	RO
2881	5	eHist.X-SE+	Status 状态	Value of Reg. 0x66 at the time the last error occurred 最后一次错误发生时 Reg. 0x66 的值	±2147483647	Num	I32	RO
2881	6	eHist.X-SEM	Status 状态	Value of Reg. 0x61 at the time the last error occurred 最后一次错误发生时 Reg. 0x61 的值	±2147483647	Num	I32	RO
2881	7	eHist.X-T-air	Status 状态	Value of Reg. 0x4B at the time the last error occurred 最后一次错误发生时 Reg. 0x4B 的值	±2147483647	Num	I32	RO
2881	8	eHist.X-dbg*temp	Status 状态	Value of Reg. 0x9A at the time the last error occurred 最后一次错误发生时 Reg. 0x9A 的值	±2147483647	Num	I32	RO
2881	9	eHist.X-dbg*ptr1	Status 状态	Value of Reg. 0xB8 at the time the last error occurred 最后一次错误发生时 Reg. 0xB8 的值	±2147483647	Num	I32	RO

CANopen Object ID CANopen Object ID 对象 ID	Sub object ID 子对象 ID	Parameter name Ser. / CAN 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Data type 数据类型	Access 访问
2881	10	eHist.X- dbg*ptr2	Status 状态	Value of Reg.0xBA at the time the last error occurred 最后一次错误发生时 Reg.0xBA 的值	±2147483647	Num	I32	RO
2881	11	eHist.X-dbg ptr1	Status 状态	Value of Reg. 0xB7 at the time the last error occurred 最后一次错误发生时 Reg. 0xB7 的值	±2147483647	Num	I32	RO
2881	12	eHist.X- dbg ptr2	Status 状态	Value of Reg. 0xB9 at the time the last error occurred 最后一次错误发生时 Reg. 0xB9 的值	±2147483647	Num	I32	RO
2882	1	eHist.E-IMD state	Status 状态	Value of Reg. 0x02 at the time the last error occurred 最后一次错误发生时 Reg. 0x02 的值	±2147483647	Num	I32	RO
2882	2	eHist.E-Device mode	Status 状态	Value of reg. 0x51 at the time the last error occurred 最后一次错误发生时 reg. 0x51 的值	±2147483647	Num	I32	RO
2882	3	eHist.E-N act (filt)	Status 状态	Value of Reg. 0xA8 at the time the last error occurred 最后一次错误发生时 Reg. 0xA8 的值	±2147483647	Num	I32	RO
2882	4	eHist.E-N cmd ramp	Status 状态	Value of reg. 0x32 at the time the last error occurred 最后一次错误发生时 reg. 0x32 的值	±2147483647	Num	I32	RO
2882	5	eHist.E-I act (filt)	Status 状态	Value of reg. 0x5F at the time the last error occurred 最后一次错误发生时 reg. 0x5F 的值	±2147483647	Num	I32	RO
2882	6	eHist.E-DC-link voltage	Status 状态	Value of reg. 0xEB at the time the last error occurred 最后一次错误发生时 reg. 0xEB 的值	±2147483647	Num	I32	RO

CANopen Object ID CANopen Object ID 对象 ID	Sub object ID 子对象 ID	Parameter name Ser. / CAN 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Data type 数据类型	Access 访问
2882	7	eHist.E-Drive status	Status 状态	Value of reg. 0x40 at the time the last error occurred 最后一次错误发生时 reg. 0x40 的值	±2147483647	Num	I32	RO
2882	8	eHist.E-Logic in block	Status 状态	Value of reg. 0x9B at the time the last error occurred 最后一次错误发生时 reg. 0x9B 的值	±2147483647	Num	I32	RO
2882	9	eHist.E-Out block	Status 状态	Value of reg. 0x98 at the time the last error occurred 最后一次错误发生时 reg. 0x98 的值	±2147483647	Num	I32	RO
2882	10	eHist.E-Power board status	Status 状态	Value of reg. 0x63 at the time the last error occurred 最后一次错误发生时 reg. 0x63 的值	±2147483647	Num	I32	RO
2882	11	eHist.E-Actual current limit	Status 状态	Value of reg. 0x48 at the time the last error occurred 最后一次错误发生时 reg. 0x48 的值	±2147483647	Num	I32	RO
2882	12	eHist.E-Current overload integral (H), and ballast energy counter	Status 状态	Value of reg. 0x45) at the time the last error occurred 最后一次错误发生时 reg. 0x45) 的值	±2147483647	Num	I32	RO
2882	13	eHist.E-Error map	Status 状态	Bit 0-15: Value of the error map (Reg. 0x8F bit 0 to 15) at the time the last error occurred Bit 16-31: ID information for the last error (for debugging). 位 0-15:最后一次错误发生时错误映射的值 (Reg. 0x8F 位 0 到 15) 位 16-31:最后一个错误的 ID 信息(用于调试)。	Binary bit mapping	Num N/A	I32	RO
2882	14	eHist.E-Elapsed time	Status	Value of elapsed time since RUN was ON	±2147483647	s	I32	RO

CANopen Object ID CANopen Object ID 对象 ID	Sub object ID 子对象 ID	Parameter name Ser. / CAN 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Data type 数据类型	Access 访问
		Dev.enable	状态	at the time the last error occurred 最后一个错误发生时,自 RUN 处于 ON 状态以来经过时间的值				
2882	15	eHist.E-Elapsed time Power ON	Status 状态	Value of elapsed time since the IMD was powered ON at the time the last error occurred 最后一个错误发生时自 IMD 上电以来经过的时间值	±2147483647	s	I32	RO
2882	16	eHist.E-Elapsed time Life	Status 状态	Value of elapsed time since the IMD was commissioned at the time the last error occurred 最后一个错误发生时自调试 IMD 以来经过的时间值	±2147483647	s	I32	RO
2883	1	eHist.P-IMD state	Status 状态	Value of Reg. 0x02 at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0x02 的值	±2147483647	Num	I32	RO
2883	2	eHist.P-Device mode	Status 状态	Value of Reg. 0x51 at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0x51 的值	±2147483647	Num	I32	RO
2883	3	eHist.P-N act (filt)	Status 状态	Value of Reg. 0xA8 at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0xA8 的值	±2147483647	Num	I32	RO
2883	4	eHist.P-N cmd ramp	Status 状态	Value of Reg. 0x32 at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0x32 的值	±2147483647	Num	I32	RO

CANopen Object ID CANopen Object ID 对象 ID	Sub object ID 子对象 ID	Parameter name Ser. / CAN 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Data type 数据类型	Access 访问
2883	5	eHist.P-I act (filt)	Status 状态	Value of Reg. 0x5F at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0x5F 的值	±2147483647	Num	I32	RO
2883	6	eHist.P-DC-link voltage	Status 状态	Value of Reg. 0xEB at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0xEB 的值	±2147483647	Num	I32	RO
2883	7	eHist.P-Drive status	Status 状态	Value of Reg. 0x40 at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0x40 的值	±2147483647	Num	I32	RO
2883	8	eHist.P-Logic in block	Status 状态	Value of Reg. 0x9B at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0x9B 的值	±2147483647	Num	I32	RO
2883	9	eHist.P-Out block	Status 状态	Value of Reg. 0x98 at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0x98 的值	±2147483647	Num	I32	RO
2883	10	eHist.P-Power board status	Status 状态	Value of Reg. 0x63 at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0x63 的值	±2147483647	Num	I32	RO
2883	11	eHist.P-Actual current limit	Status 状态	Value of Reg. 0x48 at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0x48 的值	±2147483647	Num	I32	RO
2883	12	eHist.P-Current overload	Status	Value of Reg. 0x45 at the time the error	±2147483647	Num	I32	RO

CANopen Object ID CANopen Object ID 对象 ID	Sub object ID 子对象 ID	Parameter name Ser. / CAN 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Data type 数据类型	Access 访问
		integral (H), and ballast energy counter	状态	defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, Reg. 0x45 的值				
2883	13	eHist.P-Error map	Status 状态	Bit 0-15: Value of the error map (Reg. 0x8F bit 0 to 15) at the time the error defined in 0x888[6] occurred Bit 16-31: ID information for the error defined in 0x888[6] (for debugging). 位 0-15 位:在 0x888[6]中定义的错误发生时, 错误映射的值(Reg. 0x8F 位 0 到 15) 位 16-31:在 0x888[6]中定义的错误的 ID 信息(用于调试)。	Binary bit mapping	Num N/A	I32	RO
2883	14	eHist.P-Elapsed time Dev.enable	Status 状态	Value of elapsed time since RUN was ON at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, 自 RUN 处于 ON 状态以来经过时间的值	±2147483647	s	I32	RO
2883	15	eHist.P-Elapsed time Power ON	Status 状态	Value of elapsed time since the IMD was powered ON at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, 自 IMD 上电以来经过时间的值	±2147483647	s	I32	RO
2883	16	eHist.P-Elapsed time Life	Status 状态	Value of elapsed time since the IMD was commissioned at the time the error defined in 0x888[6] occurred 在 0x888[6]中定义的错误发生时, 自 IMD 调试以来经过时间的值	±2147483647	s	I32	RO
2884	1	eHist.NC-err0_cnt	Status 状态	Number of Errors of “Error 0” type in the error history 错误历史记录中 “错误 0” 类型的错误数	0 .. 4294967295	Num	U32	RO

CANopen Object ID CANopen Object ID 对象 ID	Sub object ID 子对象 ID	Parameter name Ser. / CAN 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Data type 数据类型	Access 访问
2884	2	eHist.NC-err1_cnt	Status 状态	Number of Errors of “Error 1” type in the error history 错误历史记录中“错误 1”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	3	eHist.NC-err2_cnt	Status 状态	Number of Errors of “Error 2” type in the error history 错误历史记录中“错误 2”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	4	eHist.NC-err3_cnt	Status 状态	Number of Errors of “Error 3” type in the error history 错误历史记录中“错误 3”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	5	eHist.NC-err4_cnt	Status 状态	Number of Errors of “Error 4” type in the error history 错误历史记录中“错误 4”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	6	eHist.NC-err5_cnt	Status 状态	Number of Errors of “Error 5” type in the error history 错误历史记录中“错误 5”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	7	eHist.NC-er6r_cnt	Status 状态	Number of Errors of “Error 6” type in the error history 错误历史记录中“错误 6”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	8	eHist.NC-err7_cnt	Status 状态	Number of Errors of “Error 7” type in the error history 错误历史记录中“错误 7”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	9	eHist.NC-err8_cnt	Status 状态	Number of Errors of “Error 8” type in the error history 错误历史记录中“错误 8”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	10	eHist.NC-err9_cnt	Status 状态	Number of Errors of “Error 9” type in the error history 错误历史记录中“错误 9”类型的错误数	0 .. 4294967295	Num	U32	RO

CANopen Object ID CANopen Object ID 对象 ID	Sub object ID 子对象 ID	Parameter name Ser. / CAN 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Data type 数据类型	Access 访问
2884	11	eHist.NC-errA_cnt	Status 状态	Number of Errors of “Error A” type in the error history 错误历史记录中“错误 A”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	12	eHist.NC-errB_cnt	Status 状态	Number of Errors of “Error B” type in the error history 错误历史记录中“错误 B”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	13	eHist.NC-errC_cnt	Status 状态	Number of Errors of “Error C” type in the error history 错误历史记录中“错误 C”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	14	eHist.NC-errD_cnt	Status 状态	Number of Errors of “Error D” type in the error history 错误历史记录中“错误 D”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	15	eHist.NC-errE_cnt	Status 状态	Number of Errors of “Error E” type in the error history 错误历史记录中“错误 E”类型的错误数	0 .. 4294967295	Num	U32	RO
2884	16	eHist.NC-errF_cnt	Status 状态	Number of Errors of “Error F” type in the error history 错误历史记录中“错误 F”类型的错误数	0 .. 4294967295	Num	U32	RO
2888	2	eHist.SP-T-run	Status 状态	Value of elapsed time since RUN was ON 自 RUN 处于 ON 状态以来经过时间的值	0 .. 4294967295	s	U32	RO
2888	3	eHist.SP-T-pwr	Status 状态	Value of elapsed time since the IMD was powered ON 自 IMD 上电以来经过时间的值	0 .. 4294967295	s	U32	RO
2888	4	eHist.SP-T-life	Status 状态	Value of elapsed time since the IMD was commissioned 自 IMD 启用以来经过的时间值	0 .. 4294967295	s	U32	RO
2888	6	eHist.SP-Index	Configuration	Index number for the error in the log to be	1..20	Num	U32	RO

CANopen Object ID CANopen Object ID 对象 ID	Sub object ID 子对象 ID	Parameter name Ser. / CAN 参数名称 Ser. / CAN	Type 类型	Function 功能	Range 范围	Unit 单位	Data type 数据类型	Access 访问
			配置	presented in 0x883[1 – 12] 在 0x883[1 – 12]中显示的日志中错误的索引号				

14. Revision history 修订历史

Apart from editorial changes the following changes have been made in this revision:

除编辑性修改外，本次修订还进行了以下修改：

Date 日期	Revision 修订	Changes 改动
2021-xx-xx	H P2	<ul style="list-style-type: none"> • “Logic in block (9B)” in “Parameter bit mapping” updated. • 更新了“参数位映射”中的“逻辑块(9B)”。 • “Configuration of Ultra-capacitor SE type parameters” header in “Configuring the charger manually” updated • 更新了“手动配置充电器”中的“超级电容器 SE 类型参数配置”标题 • “Retrieving error additional information (error snapshot)” added to “Operational procedures” • “操作程序”中添加了“检索错误附加信息（错误快照）” • “Configuring speed parameters” in “Configuring the general parameters” updated • 更新了“配置通用参数”中的“配置速度参数” • “Configuring the general servo fields” in “Configuring the control parameters data” updated • 更新了“配置控制参数数据”中的“配置通用伺服字段” • “Configuring speed parameters” in “Configuring the control parameters data” updated • 更新了“配置控制参数数据”中的“配置速度参数” • “CAN/CANopen interface” in “Communication” updated • 更新了“通讯”中的“CAN/CANopen 接口” • “Internal flags” in “Functions description” updated • 更新了“功能说明”中的“内部标志” • “Parameter list” updated • 更新了“参数列表” • “Electrical work” in “Safety precautions” updated • 更新了“安全注意事项”中的“电气作业” • “Safety requirements” added to “Integrating the IMD in the cabinet” • 在“将 IMD 集成到变桨柜中”中增加了“安全要求” • “Safety requirements consideration” in “Temperature considerations” removed (content moved to “Safety requirements”) • 删除“温度注意事项”中的“安全要求注意事项”（内容移至

		<p>“安全要求”)</p> <ul style="list-style-type: none"> • “Environmental requirements” in “Integrating the IMD in the cabinet” updated • 更新了“将 IMD 集成到变桨柜中”中的“环境要求” • General description in “Manual operation” in “Operational procedures updated • 更新了“操作程序”中“手动操作”中的一般说明 • “User demand (03)” in “Parameter bit mapping” updated • 更新了“参数位映射”中的“用户需求 (03)”
2020-09-25	G	<ul style="list-style-type: none"> • “Updating Firmware” and “Turning the power to the IMD on” added to “Operational procedures” • “操作程序”中增加了“更新固件”和“打开 IMD 电源” • “Digital inputs and outputs” title in “Operational procedures” changed to “Using digital inputs and outputs” • “操作程序”中的“数字输入和输出”标题改为“使用数字输入和输出” • “Firmware update through CANopen implementation guidelines” added to “CANopen interface” • “通过 CANopen 实施指南进行固件更新”添加到“CANopen 接口”将 • “Safe energy connection requirements” in “Power connections (X1)” updated • 更新了“电源连接 (X1)”中的“后备电源连接要求” • “Connecting the safe energy” in “Avoiding damage to the IMD” updated • 更新了“避免损坏 IMD”中的“连接后备电源” • “Charger (option) warning” in “Warning list” updated • 更新了“警告列表”中的“充电器 (选项) 警告” • “Pre-heating the motor” in “Operational procedures” updated • 更新了“操作程序”中的“电机预热” • “Parameter list” updated • 更新了“参数列表” • IMD states chart and description updated • 更新了 IMD 状态图表和描述 • “Configuring motor data” in “Configuring general parameters” updated • 更新了“配置通用参数”中的“配置电机数据” • “Brake control” description in “Function Description” updated • 更新了“功能描述”中的“制动控制”描述

		<ul style="list-style-type: none"> • “User demand (03)” in “Parameter bit mapping” updated • 更新了“参数位映射”中的“用户需求（03）”
2020-06-29	F	<ul style="list-style-type: none"> • Ballast OFF calculation corrected in “Configuring the general servo fields” • 在“配置通用伺服场”中修正了镇流器关闭计算 • “Parameter list” updated with regards to retrieval of high/low part of registers through CAN/CANopen • 更新了关于通过 CAN/CANopen 检索寄存器高/低部分的“参数列表” • IMD states chart updated • 更新了 IMD 状态图表 • “Converting torque values” updated • 更新了“转换扭矩值” • “Configuring speed parameters” updated • 更新了“配置速度参数” • “Converting voltage units to volts” updated • 更新了“将电压单位转换为伏特” • Screen dumps in “Configuring general parameters” and “Configuring the control parameters data” updated • 更新了“配置通用参数”和“配置控制参数数据”中的屏幕转储 • “Charger parameters” in “Parameter list” updated. • 更新了“参数列表”中的“充电器参数”。 • “Charger (option) warnings” and “Charger (option) errors” added to “Errors and warnings” • 在“错误和警告”中添加了“充电器（选项）警告”和“充电器（选项）错误” • “Configuring the general servo fields” updated • 更新了“配置通用伺服字段” • “Disconnecting AC mains from DC-link (Mains, disconnect)” updated • 更新了“从直流母线断开交流电源（电源，断开连接）” • “Safe energy (ultra-capacitors only) discharging” added to “Operational procedures” • 在“操作程序”中添加了“后备电源（仅限超级电容器）放电” • Changing actual position value (Pos. preset) updated • 更新了更改实际位置值（位置预设） • Updated with IMD 135: “Temperature considerations”, “Mounting of the IMD in the

		<p>cabinet”, “Electrical HW connections and requirements” (overview), “Power connections (X1)”</p> <ul style="list-style-type: none"> • 更新了 IMD 135: “温度注意事项”、“在机柜中安装 IMD”、“电气硬件连接和要求”（概述）、“电源连接 (X1)” • “Error log” added to “Errors and warnings” • 将“错误日志”添加到“错误和警告” • “Error history parameters added to “Parameter list”. • 将“错误历史参数添加到“参数列表”。 • Changing actual position value (Pos. preset) updated • 更新了更改实际位置值（位置预设）
-2020-01-31	E	<ul style="list-style-type: none"> • “Configuring SE charger parameters (option)” updated • 更新了“配置 SE 充电器参数（选项）” • “Environmental requirements” updated • 更新了“环境要求” • “Configuring general servo (IMD) fields” in “Configuring general parameters” updated • 更新了“配置通用参数”中的“配置通用伺服 (IMD) 字段” • “Configuring virtual limit switches” added to “Configuring general parameters” • 将“配置虚拟限位开关”添加到“配置通用参数” • “Manual operation” in “Operational procedures” updated • 更新了“操作程序”中的“手动操作” • New procedure for “Manual operation 360” added to “Operational procedures” • “操作程序”中增加了“手动操作 360”的新程序 • New procedure for “Restarting the IMD” added to “Operational procedures” • “操作程序”中增加了“重新启动 IMD”的新程序 • “User options (01)” in “Parameter bit mapping” updated • 更新了“参数位映射”中的“用户选项（01）” • “Brake control” section in “Functions description” updated • 更新了“功能描述”中的“制动控制”部分 • “Connecting 24V (X7)” in “Connecting 24V, digital and safety I/O (X7, X8, X9)” updated • 更新了“连接 24V、数字和安全 I/O (X7、X8、X9)”中的“连接 24V (X7)” • IMD states chart updated • 更新了 IMD 状态图表

		<ul style="list-style-type: none"> • Section “Free space around the IMD” is updated with IMD 122 C • “IMD 周围的自由空间” 部分更新为 IMD 122 C • “Motor connection requirements” updated • 更新了 “电机连接要求” • “Configuring input-output logic” updated • 更新了 “配置输入输出逻辑” • “Error and warning lists” section renamed to “Errors and warnings” • “错误和警告列表” 部分重命名为 “错误和警告” • “Errors/warnings (8F)” section updated • 更新了 “错误/警告 (8F)” 部分 • Figure 13IMD 122 C / 135 updated • 更新了图 13 IMD 122 C / 135
2019-09-03	D	<ul style="list-style-type: none"> • “Parameter list” updated and “Charger parameters” added • 更新了 “参数列表” 并添加了 “充电器参数” • State flowchart and description updated • 更新了状态流程图和描述 • “Converting torque values” added to “Units conversion” • 将 “转换扭矩值” 添加到 “单位转换” • Error and warning lists updated • 更新了错误和警告列表
2019-08-19	C	<ul style="list-style-type: none"> • “Avoiding damage to the IMD” section added • 添加了 “避免损坏 IMD” 部分 • “Power connection (X1)” is updated with IMD 122 C • 将 “电源连接 (X1)” 更新为 IMD 122 C • PTC resistor added to “Motor connections requirements” and “Connecting temperature sensors” sections • 将 PTC 电阻器添加到 “电机连接要求” 和 “连接温度传感器” 部分 • Specifications for digital output corrected • 修正了数字输出的规格 • “Connecting 24 V (X7)” updated • 更新了 “连接 24 V (X7)” • “Motor brake requirement” added to “Connecting the motor brake” section • 将 “电机制动器要求” 添加到 “连接电机制动器” 部分 • Manual operation added in “Connecting digital inputs (X9)”

and “Operational procedures” sections

- 在“连接数字输入（X9）”和“操作程序”部分添加了手动操作
- Manual activation of fan added to operational procedures
- 在操作程序中增加了手动启动风扇
- Configuring manual operation and Ballast resistor energy thermal factor added to “Configuring general servo fields” section
- 将配置手动操作和镇流器电阻能量热因数添加到“配置一般伺服字段”部分
- Pictures from IMD Manager updated
- 更新了来自 IMD 监控软件的图片
- IMD states description updated with states 58 and 59. Conditions to proceed updated with manual operation where applicable, and conditions priority removed
- IMD 状态描述更新为状态 58 和 59。继续操作的条件更新为手动操作（如适用），且条件优先级已删除
- “Brake control” section moved from the “Function description” manual to the “Functions description” section.
- “制动控制”部分从“功能概要”手册移至“功能概要”部分。
- “User options (01)” bit mapping section updated
- 更新了“用户选项（01）”位映射部分
- “User state (02)” section updated
- 更新了用户状态（02）”部分
- “User demand (03)” section updated
- 更新了“用户需求（03）”部分
- “Logic IN block (9B)” section updated
- 更新了“逻辑输入块 (9B)”部分
- “Parameter list” section updated
- 更新了“参数列表”部分
- Ballast ON calculation in “Configuring the general servo fields” corrected
- 更正了“配置通用伺服场”中的镇流器开启计算
- Speed parameter configuration updated (S-run speed profile)
- 更新了速度参数配置（S-run 速度曲线）
- “Safe energy monitoring” added to “Functions description”
- 在“功能描述”增加“后备电源监控”
- “Configuring SE charger parameters (option)” added to “IMD configuration”

		<ul style="list-style-type: none">• 将“配置 SE 充电器参数（选项）”添加到“IMD 配置”
2018-06-01	B	<ul style="list-style-type: none">• Connecting 24V (X7) section updated• 更新了连接 24V (X7) 部分• Configuring General servo fields section updated• 更新了配置通用伺服字段部分• Terms and abbreviation section updated• 更新了术语和缩写部分
2018-03-16	A	<p>This is the first version of the document. 这是该文档的第一个版本。</p>

15. Product user documentation 产品用户文档

The IMD product has an extensive user documentation, targeted towards different audience and product use stages.

The following documents are part of the user documentation:

IMD 产品有广泛的用户文档，针对不同的受众和产品使用阶段。

以下文档是用户文档的一部分：

Table 44 IMD user documentation

表 44 IMD 用户文档

Document 文档	Target audience 目标受众	Content 内容
IMD 100 datasheet Document no.: 4921260015 IMD 100 数据表 文件编号： 4921260015	Buyers and technicians of customers 客户的买家和技术人员	Describes relevant specifications and give an overview of the IMD functions 介绍相关规范，并概述 IMD 功能
IMD 100 function description Document no.: 4189360013 IMD 100 功能概要 文件编号： 4189360013	Mainly technicians and engineers of customers. 主要是客户的技术人员和工程师。	Describes the functions of the IMD. Gives the reader an understanding of the purpose of the IMD in a system, and which functions can be utilised in a pitch system. The functions are described so that the reader can understand what each function is used for. 描述 IMD 的功能。让读者了解 IMD 在系统中的用途，以及可以在变桨系统使用哪些功能。描述了这些功能，以便读者可以了解每个功能的用途。
IMD 100 integration manual Document no.: 4189360015 IMD 100 集成手册 文件编号： 4189360015	Engineers at customer R&D department 客户研发部的工程师	Describes how to integrate the IMD in a pitch system. Gives extensive knowledge about: IMD SW (parameters and how to achieve specific functionality) How to create customized parameter file for use in production Requirements for external interfaces/components 描述如何将 IMD 集成到变桨系统中。提供有关以下方面的广泛知识： IMD 软件（参数以及如何实现特定功能） 如何创建用于生产的自定义参数文件 对外部接口/组件的要求
IMD Manager installation instructions Document no.: 4189360018 IMD 监控软件安装说明 文件编号： 4189360018	Engineers at customer R&D department, as well as commissioners and service personnel 客户研发部的工程师，以及专员和服务人员	Describes how to install the IMD Manager. The IMD Manager is an application used to configure and control the IMD using the Service USB connector. 介绍如何安装 IMD 监控软件。 IMD 监控软件是一个应用程序，用于使用服务 USB 连接器配置和控制 IMD。
IMD Manager user manual	Engineers at customer R&D department, as well	Describes how to use the IMD Manager. The IMD Manager is an application used to configure

Document 文档	Target audience 目标受众	Content 内容
Document no.: 4189360019	as commissioners and service personnel 客户研发部的工程师，以及专员和服务人员	and control the IMD using the Service USB connector. 介绍 IMD 监控软件的使用方法。 IMD 监控软件是一个应用程序，用于使用服务 USB 连接器配置和控制 IMD。
IMD 100 installation instructions Document no.: 4189360005 IMD 100 安装说明 文件编号：41893605	Technicians at production site where the IMD is mounted in the cabinet/hub IMD 安装在机柜/轮毂上的生产现场的技术人员	Describes how to mount, connect and perform initial start, test, and configuration (using a configuration file) of the IMD at production. 描述如何在生产中安装、连接和执行 IMD 的初始启动、测试和配置（使用配置文件）。
IMD 100 initial configuration and verification manual Document no.: 4189360016 IMD 100 初始配置和验证手册 文件编号： 4189360016	Commissioners or other personnel with similar qualifications, as well as service personnel (for SW upgrade) 专员或其他具有类似资格的人员，以及服务人员（用于软件升级）	Describes how to upgrade the IMD SW, how to load configuration file, and how to verify the IMD installation to the possible extent. 描述如何升级 IMD SW、如何加载配置文件以及如何尽可能验证 IMD 安装。
IMD 100 service and maintenance manual Document no.: 4189360017 IMD 100 维修和保养手册 文件编号： 4189360017	Service and warehouse personnel 服务和仓库人员	Describes preventive (scheduled) and corrective maintenance of the IMD, as well as storage requirements. 描述 IMD 的预防性（计划）和纠正性维护以及存储要求。
IMD 100 installation checklist Document no.: 4189360021 IMD 100 安装检查表 文件编号： 4189360021	Technicians at production site where the IMD is mounted in the cabinet/hub IMD 安装在机柜/轮毂上的生产现场的技术人员	Installation tasks with check boxes to document the tasks done during installation 带有复选框的安装任务，用于记录安装过程中完成的任务
IMD 100 configuration and verification checklist Document no.: 4189360022 IMD 100 配置和验证检查表 文件编号： 4189360022	Commissioners or other personnel with similar qualifications, as well as service personnel (for SW upgrade) 专员或其他具有类似资格的人员，以及服务人员（用于软件升级）	configuration and verification tasks with check boxes to document the tasks done during configuration and verification 带有复选框的配置和验证任务，用于记录配置和验证期间完成的任务
Addendum to installation manual Document no.: 4189360023 安装手册附录	Integration and installation personnel 集成安装人员	Describes the how to replace a pitch drive when the IMD is equipped with Retrofit wiring harness var.1 描述当 IMD 配备改装线束 var.1 时如何更换变桨驱动

Document 文档	Target audience 目标受众	Content 内容
文件编号： 4189360023		

The IMD 100 documentation is written anticipating an OEM (original equipment manufacturer) product use-cycle in a wind turbine. The envisioned cycle is described in the following figure. The description also explains the tasks, who is expected to execute the task, the location where the execution takes place and the supporting DEIF documentation for the task. Many details in these tasks depends on the actual implementation, which is why the IMD documentation will never stand alone.

IMD 100 文档是针对风力涡轮机中的 OEM（原始设备制造商）产品预设使用周期编写的。下图描述了设想的周期。该描述还解释了任务、预计谁来执行任务、执行发生的位置以及任务的支持性 DEIF 文档。这些任务中的许多细节取决于实际执行，这就是为什么 IMD 文档永远不会独立存在的原因。

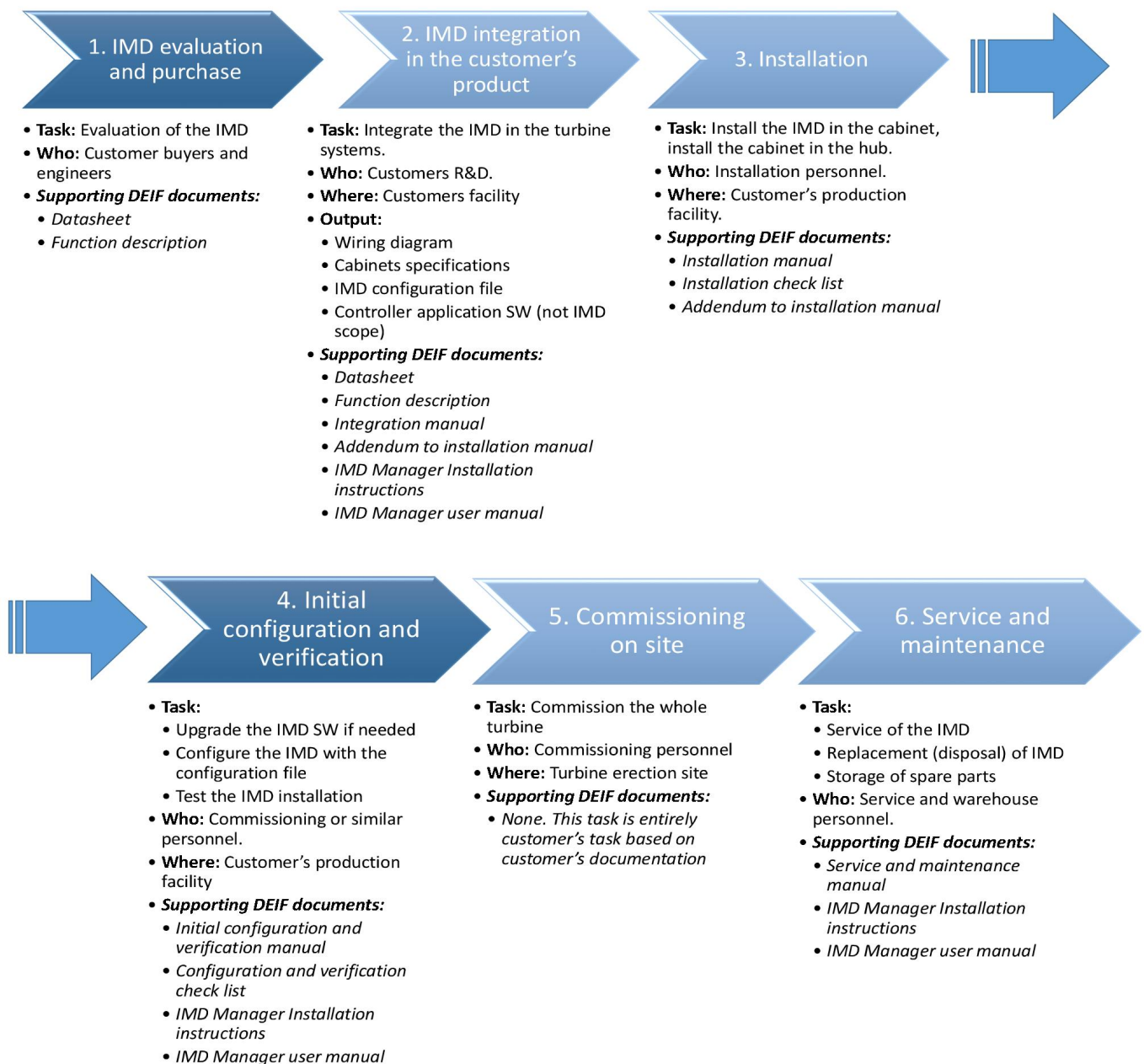


Figure 45 Tasks and documentation overview

图 45 任务和文档概述

The described product use-cycle might not apply as is for all customers, but the tasks are universal and can therefore be adapted. For example, if the SW upgrade, configuration and verification is done during the turbine commissioning, the applicable documentation can be used at this stage instead of a separate stage at the end of production.

所描述的产品使用周期可能并不适用于所有客户，但任务是通用的，因此可以进行调整。例如，如果在风机调试期间进行软件升级、配置和验证，则可在此阶段使用适用的文档，而不是在生产结束时使用单独的阶段。

16. Glossary 词汇表

16.1 Terms and abbreviations 术语和缩写

Async.	Asynchronous 异步
CAN	Controller Area Network 控制器局域网
COB ID	Communication Object Identifier (CAN/CANopen interface) 通信对象标识符 (CAN/CANopen 接口)
EMC	Electro Magnetic Compatibility 电磁兼容性
EMI	Electro Magnetic Interference 电磁干扰
ID	Identification 识别
IMD	Integrated Motor Drive 集成电机驱动
LoS	Loss of Signal 信号丢失
LSB	Least Significant Bit/Byte 最低有效位/字节
MSB	Most Significant Bit/Byte 最高有效位/字节
N/A	Not Applicable 不适用
PDO	Process Data Object (CAN/CANopen interface) 流程数据对象 (CAN/CANopen 接口)
PE	Protective Earthing 保护接地
PID	Proportional Integral Derivative (controller) 比例积分微分 (控制器)
PMC	Pitch Motor Controller 变桨电机控制器
PWM	Pulse Width Modulation 脉冲宽度调制
RFE	Rotational Field Enable 旋转场启用
RMS	Root Mean Square 均方根
RPDO	Receive Process Data Object (CAN/CANopen interface) 接收过程数据对象 (CAN/CANopen 接口)
RPM	Revolutions Per Minute 每分钟转数
RWW	Read, write and mappable to RPDO 读取、写入和映射到 RPDO
SCI	Safety-Chain Input 安全链输入
SCR	Safety-Chain Relay 安全链继电器
SDO	Service Data Object (CAN/CANopen interface) 服务数据对象 (CAN/CANopen 接口)
SE	Safe Energy 后备电源

SSI	Synchronous Serial Interface 同步串行接口
TPDO	Transmit Process Data Object (CAN/CANopen interface) 传输过程数据对象 (CAN/CANopen 接口)

16.2 Units 单位

Unit 单位	Unit Name 单位名称	Quantity name 数量名称	US unit 美国单位	US name 美国名称	Conversion 美国名称	Alternative units 替代单位
A	Ampere 安培	Current 电流				
Bar	Bar 压力	Pressure 压力	psi	pounds per square inch 每平方英寸磅	1 bar = 14.5 psi	1 bar = 0.980665 atmosphere (atm) 1 bar = 100,000 Pascal (Pa) 1 巴 = 0.980665 大气压 (atm) 1 巴 = 100000 帕斯卡 (帕)
°C	degrees Celsius 摄氏度	Temperature 温度	°F	Fahrenheit 华氏度	$T(^{\circ}F) = T(^{\circ}C) \times 1.8 + 32$	
dB	Decibel 分贝	Noise or interference (a logarithmic scale) 噪音或干扰(对数尺度)				
g	Gram 克	Weight 重量	oz	Ounce 盎司	1 g = 0.03527 oz	
Hz	Hertz 赫兹	Frequency (cycles per second) 频率(周期/秒)				
bps	Bits per second 每秒位数	Data transmission speed 数据传输速度				
kg	Kilogram 公斤	Weight 重量	lb	Pound 磅	1 kg = 2.205 lb	

Unit 单位	Unit Name 单位名称	Quantity name 数量名称	US unit 美国单位	US name 美国名称	Conversion 美国名称	Alternative units 替代单位
m	Metre 米	Length 长度	ft	foot (or feet) 脚	1 m = 3.28 ft	
mA	Milliampere 毫安	Current 电流				
mm	Millimetre 毫米	Length 长度	in	Inch 英寸	1 mm = 0.0394 in	
mm ²	Square millimetre 平方毫米	Wire cross section 导线横截面	AWG	American wire gauge 美国线规	Look up in available conversion tables 查找可用的转换表	
ms	Millisecond 毫秒	Time 时间				
Nm	Newton metre 牛顿米	Torque 扭矩	Lb-in	pound-force inch 磅力英寸	1 Nm = 8.85 lb-in	
RPM	revolutions per minute 每分钟转数	Frequency of rotation (rotational speed) 旋转频率（旋转速度）				
s	Second 秒	Time 时间				
V	Volt 伏特	Voltage 电压				
V AC	volt (alternating current) 伏特（交流电）	Voltage (alternating current) 电压（交流电）				
V DC	volt (direct current) 伏特（直流电）	Voltage (direct current) 电压（直流电）				
W	watt 瓦特	Power 功率				
Ω	Ohm 欧姆	Resistance 电阻				