
ABB变频一体机LV Titanium VSM快速启动指南
Quick Start Guide of
ABB LV Titanium Variable Speed Motor



EU Declaration of Conformity

The products: Variable speed motors of the series.

VSMJ

Shaft heights: 71, 80, 90

Fixing dimensions: M_, L_

Output power code: A, B, C, D, E

Pole numbers: 6

e.g. VSMJ 90LB 6

The Manufacturer:

ABB Shanghai Motors Co., Ltd.

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This declaration of conformity is issued under the sole responsibility of the manufacturer.

The products of the declaration as listed above are in conformity with the following Union harmonization legislation:

Directive 2014/35/EU

and the Principal Elements of the Safety Objectives for Electrical Equipment stated in the Annex I.

Directive 2006/42/EC

and the Essential health and safety requirements relating to the the design and construction of machinery stated in the Annex I, as the variable frequency drive module of the product is mentioned as a safety components in the (c) of No. 1 of Article 1 of the Directive 2006/42/EC.

Notes: The conformity of the incorporation into a finished machine according to the Directive 2006/42/EC shall be established by the commissioning party when motor is assembled to the machinery.

Directive 2014/30/EU

and the ESSENTIAL REQUIREMENTS stated in the Annex I.

Directive 2011/65/EU

and the amending Annex II in the (EU) 2015/863 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. Technical documentation based on the harmonized standard EN IEC 63000:2018.

Energy Efficiency

IE class and markings, if indicated, are declared based on the standard EN IEC TS 60034-30-2:2021 and efficiency determined based on EN IEC 60034-2-3:2024. IES class and markings, if indicated, are declared based on the standard EN IEC 61800-9-2:2025.

The following harmonized standards were applied in relation to which conformity is declared:

EN 60034-1:2010, EN 60034-5:2001/A1:2007, EN 60034-6:1993, EN 60034-7:1993/A1:2001, EN 60034-8:2007/A1:2014, EN 60034-9:2005/A1:2007, EN 60034-14:2004-/A1:2007, EN 61800-3:2004/A1:2012, EN 61800-5-1:2007/A1:2017/A11:2021, EN 61800-5-2:2007.

3GZC500930-180 B

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1. 一般说明

注意

为确保安全、正确地安装、操作和维护机器，请务必遵守以下各项说明。安装、操作或维护机器或相关设备的人员应仔细阅读这些说明。本机器只能由熟悉健康和国家安全要求及国家法规的合格人员安装和使用。忽视这些说明会导致所有适用的担保失效。

1.1 ABB 变频一体机 LV Titanium VSM

ABB 变频一体机 LV Titanium VSM 简称“VSM”，是一种集成变频器的三相永磁电机。铭牌上列有机器参数，包括轴承配置、驱动器信息、重量、系统效率等。

1.2 使用条件

- 环境温度的正常范围为 -20°C 至 $+50^{\circ}\text{C}$ 。 $+40^{\circ}\text{C}$ 以上需要降额使用。
- 最高海拔 2000m。1000m 以上需要降功率使用。
- 环境相对湿度最高为 95%，无水珠凝结。
- 驱动器的输入电压容差 380-480V(+10/-15%)，频率 47-63Hz。
- 铭牌上标有额定值和工作条件。

VSM 只能应用于满足上述条件的环境。此外，本手册中的所有要求以及其他相关说明和标准必须遵守。

如果超出这些限制条件，请联系 ABB。

警告

不遵守说明或设备维护手册可能会造成安全隐患。在这种情况下，请勿使用本电机。

1.3 符合性声明

将电机安装到机器上，调试方必须确保产品符合欧盟机械指令 2006/42/EC。

VSM 作为组件使用与机械指令 (MD) 89/392/EEC 中定义的工业和商业设施。在确定最终产品符合指令之前，禁止调试 (遵循特定的当地安全和安装规则，例如 EN 60204)。

这些机器符合 EN 60034 / DIN VDE 0530 系列标准。除非明确设计用于危险区域，否则禁止在危险区域使用。

1.4 VSM 噪声

在额定频率下，多数 ABB 电机的噪音水平低于 82dB (A)。

2. 术语和缩写

表 1

术语	定义
VSM	ABB 变频一体机 LV Titanium VSM
Drive	用于控制交流电机的变频器
X1、X2、X3、X4	数字输入端子
DO	数字输出端子
STO1、STO2	安全转矩关闭端子
FI	模拟输入
FIV	模拟电压输入端子；模拟电压输入信号接口
FIC	模拟电流输入端子；模拟电流输入信号接口
FO	模拟输出端子；模拟输出信号接口
FOC	模拟输出
EMC	电磁兼容性
ID run	参数自主学习运行
PID	比例 - 积分 - 微分控制
PMSM	永磁同步电机
PLC	可编程逻辑控制器
SIL	安全完整性等级
PDS	动力驱动系统
C3	电压低于 1000V 的工业使用区域，不含居民区，商业和轻工业区
C2	电压低于 1000V 的商业和轻工业区域，不含居民区
THD	总谐波失真

3. 搬运

3.1 收货检查

收到 VSM 后立即检查。

- 检查参数是否与订单信息匹配。
- 检查 是否有任何外部损坏 (如轴端、法兰面、涂漆面、控制面板等)，如果发现损坏，请立即通知货运代理商。

3.2 运输和存放

电机应始终在干燥 (温度高于 -20°C)、无振动和无尘的室内环境中存放。

在运输过程中，应避免撞击、掉落和受潮。

电机在静止状态下不应受到任何外部震动，以免损坏轴承。

3.3 起吊

重量超出 25 公斤的所有 ABB 电机都配有吊耳或吊环螺栓。

电机只能用主吊环或吊环螺栓起吊。

不得使用接线盒起吊电机。

由于输出功率、安装方式和辅助设备的不同，相同机座号的电机重心可能有所变化。

不得使用损坏的吊环。在起吊前请检查吊环螺栓或一体式吊环是否完好无损。

确保使用正确的起重设备，吊钩尺寸也必须与吊环相匹配。

4. 机械安装调试

警告

对 VSM 或驱动设备操作之前请断开电源并锁定。

4.1 概述

警告

若在安装电机时，轴朝上安装，则水或液体可能沿着轴下流，用户必须考虑采取措施，防止出现此类情况。打开装运锁（若已使用）。用手转动电机轴，检查其是否能自由旋转。

4.2 底座

所有底座准备工作由终端用户承担。

金属底座应该涂漆，以防生锈。

底座必须平整（参见下图）、坚固、足以抵抗短路产生的冲击力。它们的设计和尺寸必须确保避免引起电机振动以及共振。

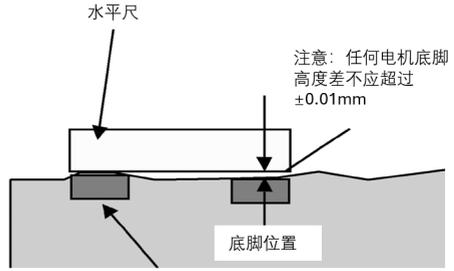


图 1

4.3 平衡和安装半联轴器和皮带轮

标准情况下，用半键来平衡电机。

当用全键平衡时，轴上贴有黄色胶带，并注明“用全键平衡”。

当进行无键平衡时，轴上贴有蓝色胶带，并注明“无键平衡”。

半联轴节或皮带轮必须用加工后的键槽来进行平衡。必须根据电机指定的平衡方法来完成平衡。

必须用合适的设备和工具来安装半联轴节和皮带轮，以免损坏轴承和密封件。

安装半联轴节或皮带轮时不要将它们敲打入位，也不要用力杆抵住机体拆下它们。

4.4 安装和校正电机

确保电机周围的空气流通充分。可以从产品目录或网址上的尺寸图中获得电机风罩后侧的最小自由空间要求：www.abb.com。

校正正确与否是避免轴承故障、振动和轴破损的关键所在。

使用合适的螺栓或双头螺栓将电机安装在底座上，并在底座和底脚之间放置薄垫板。

用合适的方法对准电机。

如适用，钻定位孔，然后将定位销固定就位。

半联轴节的安装精度：检查间隙 b，确保其小于 0.05mm，a1 和 a2 之间的间隙也应小于

0.05mm。请参阅下图。

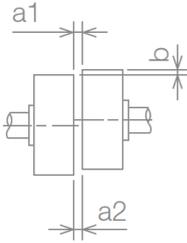


图 2

在紧固螺栓或双头螺栓后，请再检查一次对准情况。

不得超过产品目录中规定的轴承允许负载值。

4.5 滑轨和皮带传动

如下图所示将电机固定到滑轨上。

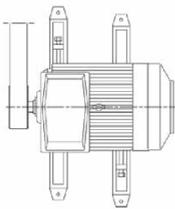


图 3

水平放置滑轨，使其处于同一平面。检查电机轴是否与主动轴平行。

必须根据从动设备供应商的说明张紧皮带。然而，不得超出相关产品目录中规定的最大皮带张力（即，径向轴承负载）。

警告

皮带过紧会损坏轴承，并有可能引起电机轴损坏。

4.6 带有冷凝排水塞的电机

检查排水孔和排水塞是否朝下。

电机在交付时，可密封塑料排水塞处于打开状态。在灰尘过多的环境中，应关闭所有排水孔。

5. 电气安装

5.1 绝缘电阻检查

注意

请勿对 VSM 进行耐压或绝缘电阻测试。这些测试可能会损坏驱动器。每个驱动器和电机在出厂时都经过主电路和地之间的绝缘测试。此外，驱动器内部还有限压电路，可自动降低测试电压。

在将输入电源线连接到驱动器之前，请根据当地法规测量电源线绝缘电阻。

5.2 电缆敷设和电气连接

5.2.1 电缆入口密封要求

VSM 电缆入口采用公制螺纹，电缆密封套的 IP 等级必须至少与 VSM 的 IP 等级相同。

警告

根据电缆类型和直径，在电缆入口处使用合适的电缆密封管及其密封件。

5.2.2 接地要求

在将 VSM 连接到电源之前，必须按照当地法规进行接地。VSM 支持两种接地方式：三相 TN 和三相 TT。

除非当地接线法规另有规定，否则保护接地导体的横截面积必须符合 IEC 60364-4-41 中第 411.3.2 条要求能自动断开电源，并且能够承受保护装置断开期间的预期故障电流。

5.2.3 主电路接线

主回路配线可与外围器件空气开关，接触器和交流电抗器连接后再接入 VSM。

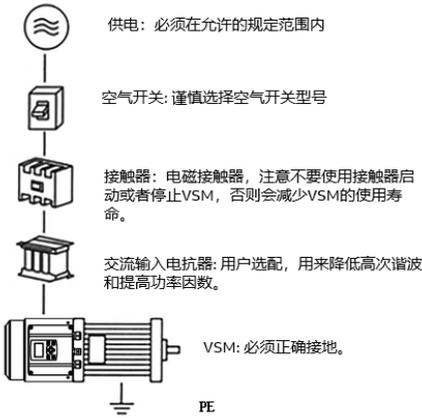


图 4

VSM 的接线盒包含三个用于电网连接的输入电源端子，见图 5。

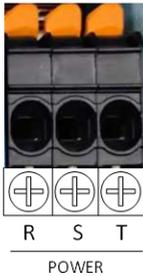


图 5

5.2.4 控制端子接线

除了电源输入端子外，还有一排信号控制端子，见图 6。

控制端子的基本接线图如图 7 所示。

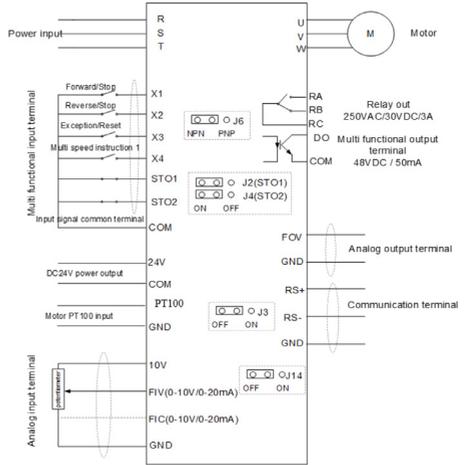


图 7 控制端子接线图

表 2

端子	描述
X1、X2、X3、X4	数字输入端子与 COM 端子连接时有效。当与控制面板上的 P4.00-P4.03 功能码结合使用时，这些数字输入端子可以向 VSM 发送数字命令。有关更多详细信息，请参考第 7.4 节。
STO1、STO2	安全转矩关闭端子。有关更多详细信息，请参考第 7.4 节。
FOV	模拟输出端子与 GND 连接时有效。当与控制面板上的功能码 P5.07 至 P5.08 结合使用时，该输出端子可以输出 0 至 10V 的电压或 0 至 20mA 的电流。有关更多详细信息，请参考第 7.5 节。
FIV、FIC	模拟输入端子与 10V 电源连接时有效。当与控制面板上的功能码 P4.13 至 P4.23 结合使用时，它们可以向 VSM 发送 0V 至 10V 的电压信号或 0mA 至 20mA 的电流信号。有关更多详细信息，请参考第 7.4 节。
PT100/GND	热敏电阻输入端口，与控制面板上的功能码 P9.56 至 P9.57 结合使用，可实现电机过热保护。有关更多详细信息，请参考第 8.1.2 节。
DO	多功能光耦合器输出端子，与控制面板上的功能码 P5.01 至 P5.03 配合使用。有关更多详细信息，请参考第 6.5 节。
RA、RB、RC	两个继电器输出 RA 和 RB 的公共端子。RA 是常开输出端口。RB 是一个常闭输出端口。这些继电器端口与控制面板上的功能码 P5.01 至 P5.03 结合使用。有关更多详细信息，请参考第 7.5 节。
RS+/RS-	RS-485 通信端子。



图 6 信号控制端子

5.2.5 电缆要求

主电路接线电缆建议使用对称屏蔽电缆(VFD 电缆)。线径要求与功率有关，如下。

表 3

功率 (kw)	电流 (A)	线径 (mm ²)
1.5-2.2	2-4	1.5
3-4	5-8	2.5
5.5-7.5	11-17	4
11-15	20-26	6
18.5-22	32-38	10
30	51	16

为防止干扰引起的故障，控制回路请使用绞合屏蔽电缆或双屏蔽双绞线电缆。建议选择 0.3-0.5mm² 的线径。

6. 操作

6.1 操作安全注意事项

- 不要踏在 VSM 上。
- 小心电机的旋转部件。
- 警告，在正常运行过程中，停机后，VSM 外壳温度可能会很高，不能触摸。
- 请勿在通电时打开接线盒。
- 在开始工作之前，将驱动器与所有危险电压源隔离，并验证是否安全。
- 断开输入电源后等待 20 分钟，让中间电路电容器放电。
- 在特殊应用（例如，使用逆变器电源）中使用 VSM 需要特殊说明。请联系 ABB。

6.2 控制面板键盘简介

以下是控制面板的示意图。



图 8

控制面板上按钮的功能如下表所示。

表 4

符号	名字	功能描述
Menu	菜单	进入或退出第一级菜单。
OK	确认	进入菜单并确认参数设置。
▲	UP 增量	数据或功能码的递增
▼	DOWN 递减	数据或功能码的递减
▶	移位键	在停机显示界面和运行显示界面中，可以循环选择显示参数。修改参数时，可以选择要修改的具体数字。
Lo/Re	本地 / 远程 切换键	Lo 表示本地控制，Re 表示远程控制。长按 3s 切换本地或远程控制。
Start	运行键	在键盘模式下，用于运行操作。
STOP	停止 / 重置 键	在运行状态下，按此键将停止运行，并受到功能码 P7.02 的限制。在故障报警状态下，可用于复位故障，不受功能码 P7.02 的限制。

控制面板的内部分为三级菜单参数：

- 一级菜单，例如 P0。
- 二级菜单，例如 P0.04。
- 三级菜单参数值，例如 150Hz。

在三级菜单状态下，如果无法更改该参数值，可能的原因有：

- 此功能码是不可修改的参数，如实际检测参数、运行记录参数等。
- 此功能码在运行状态下无法修改，只能在停机后修改。

6.3 操作流程及启动

VSM 上电后首先初始化，初始化完成后处于待机状态。

如果用户不需要改变速度等任何性能，可以直接按下键盘上的运行键，电机将加速到铭牌的额定速度。

如果用户需要调整转速等控制命令，可以根据功能码指令直接在控制面板上修改参数。

示例：将功能码 P1.04 从 50.00Hz 更改为 40.00Hz。

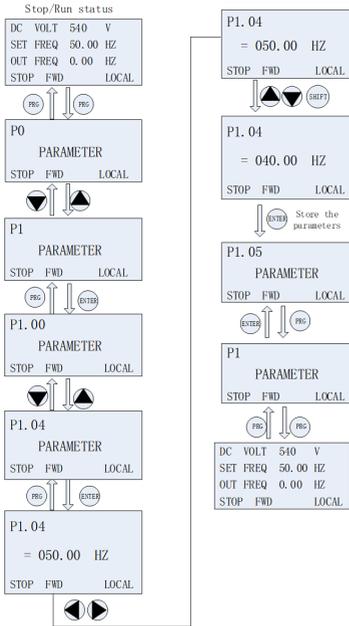


图 9

注意

VSM 在出厂时未配置启动保护功能。通电或故障复位后，如果控制端子同时发出启动指令，电机将加速至铭牌上标明的额定转速。如果终端用户需要启动保护功能，可以根据功能码 P8.18 的说明进行设置。

6.4 远程操作

如果 VSM 上的集成面板使用不方便，用户可以通过控制端子或外部控制面板远程修改 VSM 的控制命令。

6.4.1. 通过控制端子进行远程控制

在尝试使用控制端子进行远程控制之前，请根据第 5.2.4 节接线要求正确连接端子，然后设置控制端子的相关功能码进行远程控制。

控制端子可以识别模拟指令、数字指令和 Modbus 通信指令。

6.4.2. 通过外接控制面板进行远程控制

外接控制面板连接到 VSM 驱动接线盒中的 RJ45 端口，其操作方式与驱动器上的集成控制面板相同。外接控制面板还具有无线连接功能，实现 PC 和手机的无线远程控制。

注意

外部控制面板作为选配件提供，请联系 ABB 了解购买信息。

6.5 语言选择

在控制面板上，同时按住 OK 键和 Stop 键可在中英文之间切换。

7. 功能码

7.1 P0 组：基本功能码

1. VSM 有两种负载模式，如下表所示。功能码 P0.00 默认设置为 1，即 G 型。

表 5

范围	描述
P0.00	1 G 型（恒扭矩负载型）。默认设置。

2. VSM 采用高性能的无位置矢量控制。

表 6

范围	描述
P0.01	0 不带速度传感器的矢量控制（不带 PG）

3. VSM 输入控制命令源选择如下表。功能码 P0.02 的默认设置为 0，因此必须使用控制面板输入初始控制命令。控制命令包括启动、停止、前进、倒车、点动等。

表 7

范围	描述
P0.02	0 控制面板命令。默认设置。
	1 远程控制端子命令
	2 RS-485 远程通信命令通道

当功能码 P0.02 设置为 1 时，输入控制命令由控制端子确定。请参考第 7.4 节，了解 P4 组的有关说明。

当功能码 P0.02 设置为 2 时，输入控制命令由上位机通过 RS-485 通信确定。若需了解更多详情，请联系 ABB。

4. VSM 的电机频率源设置如下表所示。默认情况下，功能码 P0.03 设置为“1”，表示电机输入频率通过控制面板进行配置，停电后将保留为预设频率。

表 8

范围	描述
P0.03 0	面板设置（P0.08 预设频率，UP/DOWN 修改，断电不存储）。
1	面板设置（P0.08 预设频率，UP/DOWN 修改，断电存储）。默认设置。
2	模拟输入端子 FIV
3	模拟输入端子 FIC
6	数字输入多段速命令
7	内置简易 PLC
8	过程 PID
9	给定 RS-485 通信

当功能码 P0.03 设置为 2 或 3 时，电机输入频率由模拟输入端子确定。VSM 提供 2 个模拟输入端子（FIV、FIC）。FIV 和 FIC 都可以读取 0V-10V 电压输入，或 4mA-20mA 电流输入，通过功能码 P4.40 选择。用户可以通过功能码 P4.33 自由选择 FIV 和 FIC 的输入电压值与电机目标输入频率的关系。

当功能码 P0.03 设置为 6 时，电机转速由 4 个数字输入端子决定，可用于设置多段速度命令。更多详情请参考 P4 组相关功能参数。

当功能码 P0.03 设置为 7 时，电机频率由内置的简易 PLC 决定。当以简易 PLC 为频率源时，电机的运行速度和方向由多段速指令决定；保持时间和循环时间也可以由用户设置。若了解更多信息，请联系 ABB。

当功能码 P0.03 设置为 8 时，电机频率由“过程 PID 控制”确定。一般用于现场过程闭环控制，如恒压或恒张力闭环控制。需要设置 PA 组“PID 功能”的相关参数。

当功能码 P0.03 设置为 9 时，电机输入频率由上位机通过 RS-485 通信确定，并参考 PD 组的相关指令。

5. 当频率源功能码 P0.03 状态设置为 0 或者 1 时，电机的运行频率由功能码 P0.08 设定。此外，P0.08 设置值可通过“端子 UP/DOWN”增加或减少。具体详情请参考 P4 组相关功能参数说明。

表 9

范围	描述
P0.08 5Hz- 最大频率	电机运行频率。

6. 功能码 P0.09 可以在不更换电机电缆相序的情况下改变电机转速，其功能相当于调整电机的任意两条线（U、V、W）来反转电机旋转方向。

注意

参数初始化后，电机运行方向将恢复到原始状态。

表 10

范围	描述
P0.09 0	旋转方向与预设方向相同
1	旋转方向与预设方向相反

7. 当使用模拟输入、数字脉冲输入、多段速命令等作为频率源时，它们各自的 100.0% 参考水平都是对应 P0.10 中设置值。

表 11

范围	描述
P0.10 5Hz -599Hz	电机运行的最大频率

8. VSM 的上限频率可以来自控制面板的数字设置（P0.12），也可以来自模拟输入端子。当使用模拟输入设置上限频率时，模拟输入的 100% 对应于 P0.12。

表 12

范围	描述
P0.11 0	功能码 P0.12 设置。默认设置。
1	模拟输入端子 FIV
2	模拟输入端子 FIC
5	RS-485 通信
P0.12 P0.14 P- P0.10 P	设置上限频率
P0.14 0.00Hz -P0.12	设置下限频率

例如在卷绕控制现场采用横转矩控制方式时，为避免材料断线出现“飞车”现象，可以用模拟量设定上限频率。当 VSM 运行至上限频率值时，VSM 保持在上限频率运行。

9. VSM 的载波频率可以通过功能码 P0.15 确定，默认为 5kHz。通过调节载波频率，可以降低电机噪声；可以避免机械系统的谐振点；减少线路对地的漏电流；并且可以减少逆变器造成的干扰。

表 13

范围	描述
P0.15	0.5kHz-6kHz 载波频率。默认值为 5kHz。

10. VSM 的载波频率可以随温度调节，由功能码 P0.16 确定。默认值为 0，即载波频率不随温度调整。

表 14

范围	描述
P0.16	0 不随温度调节。默认设置。
	1 随温度调节

11. VSM 的加速时间和减速时间分别由功能码 P0.17 和 P0.18 设置。

加速时间是指 VSM 从 0Hz 加速到加减速基频（功能码 P0.25 设定值）所需的时间。

减速时间是指 VSM 从加减速的基准频率（P0.25 设定值）减速到 0Hz 所需的时间。

表 15

范围	描述
P0.17	0.00 秒 - 6500.0 秒 加速时间
P0.18	0.00 秒 - 6500.0 秒 减速时间

12. VSM 提供三种加减速时间单位，分别为 1 秒、0.1 秒、0.01 秒。

表 16

范围	描述
P 0.16 P	0 1 秒
	1 0.1 秒。默认设置。
	2 0.01 秒

13. VSM 的加速时间参考频率可以通过功能码 P0.25 确定。当选择 1 时，加减速时间与设定频率相关。如果设定频率频繁变化，电机的加速度频繁变化，应用时需要注意。

表 17

范围	描述
P 0.25	0 加速时间的基频为最大频率（P0.10）。默认设置。
	1 加速时间的基频为设定频率
	2 加速时间参考频率为 100Hz

14. 功能码 P0.27 用于将三个运行命令源与七个频率源绑定，便于同步切换。

P0.27 中频率源的含义与 P0.03 中的含义相同。请参考功能码 P0.03 的说明。不同的运行命令源可捆绑相同的频率源。如果命令源具有绑定频率源，则启用绑定频率源时，P0.03 中设置的数字频率源将不再工作。

表 18

个位	操作面板命令绑定频率源选择
P0.27	0 无捆绑
	1 面板数字设定频率源
	2 FIV
	3 FIC
	6 数字输入多段速命令
	7 简易 PLC
	8 过程 PID
	9 RS-485 通讯给定
十位	端子命令绑定频率源选择（0 ~ 9，同个位）
百位	通讯命令绑定频率源选择（0 ~ 9，同个位）

7.2 P1 组：电机参数

1. VSM 的电机参数可通过 P1.00-P1.05 确认，必须与铭牌中电机参数一致。

表 19

范围	描述
P1.00	2 永磁同步电机
P1.01	0.1-7.5kW 额定功率
P1.02	1-500V 额定电压
P1.03	0.01-13A 额定电流
P1.04	75Hz/150Hz/225Hz 额定频率
P 1.05	1500rpm/3000rpm/4500rpm 额定转速

2. 功能码 P1.37 用于设置 VSM 的 ID 运行模式，初始的参数自学习在工厂完成。

静态模式适用于电机不易断开负载、无法进行动态模式的场合。在静态模式之前，必须正确设置电机类型和电机铭牌参数（P1.01-P1.05）。驱动器可以通过静态模式获取三个电机参数（P1.16-P1.18）。动作说明：将功能码设置为 11，然后按 RUN 键，VSM 将执行静态模式。

动态模式下，VSM 首先执行静态模式，然后根据加速时间（P0.17）加速到电机额定频率的 80%。维持一定时间后，根据减速时间（P0.18）减速停止，结束 ID 运行。动作说明：将功能码设置为 12，然后按下 RUN 键，VSM 将进行动态自学习。

表 20

范围	描述
P 1.37	0 无作
	11 静止模式
	12 动态模式

注意

VSM 在出厂前已根据铭牌正确地设置电机参数，并完成了 ID 运行。

7.3 P2 组： 矢量控制功能码

当 VSM 运行在不同频率下，可以选择不同的速度控制环 PI 参数。运行频率小于切换频率 1 (P2.02) 时，速度控制环 PI 调节参数为 P2.00 和 P2.01。运行频率大于切换频率 2 时，速度换 PI 调节参数为 P2.03 和 P2.04。切换频率 1 和切换频率 2 之间的速度控制环 PI 参数，为两组 PI 参数线性切换。

表 21

范围	描述
P2.00	1-100 速度环比例增益 1
P2.01	0.01-10.00 秒 速度环积分时间 1
P2.02	0.00-P2.05 切换频率 1
P2.03	1-100 速度环比例增益 2
P2.04	0.01-10.00 秒 速度环积分时间 2
P2.05	P2.02 - 最大输出频率 切换频率 2

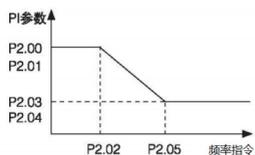


图 10

如果控制参数不符合应用要求，请联系 ABB 售后。

7.4 P4 组： 输入端子

VSM 配备 4 个数字输入端子、2 个 STO 输入端子和 2 个模拟输入端子。数字输入端子和 STO 输入端子的功能码定义如表所示。

表 22

范围	描述
P4.00	0-50 X1 端子功能选择
P4.01	0-50 X2 端子功能选择
P4.02	0-50 X3 端子功能选择
P4.03	0-50 X4 端子功能选择
P4.06	57 STO2 端子功能选择
P4.07	56 STO1 端子功能选择

1. 数字输入端子 X1、X2、X3 和 X4 各可选择的功能如下表所示。

表 23

设定值	功能	描述
1	正转运行	VSM 由外部端子控制，可正向和反向运行。
2	反转运行	
6	UP 端子	当频率由外部端子给定时，用于修改频率的递增和递减命令。当频率由为数字设置给定时，可以向上或向下调整设定频率。
7	DOWN 端子	
8	自由停车	变频器封锁输出，此时电机的停车过程不受变频器控制。
9	故障复位	此功能使用端子来复位故障。该功能与键盘上的 RESET 键相同。此功能可实现远距离故障复位。
10	运行暂停	VSM 减速停止运行，但运行参数全部记忆，如 PLC、摆动频率和 PID 参数。禁用此功能后，VSM 在停止之前恢复其状态。
12	多段速端子 1	这四个端子的 16 个状态可以用来设置 16 个速度命令或者 16 个其他命令。
13	多段速端子 2	
14	多段速端子 3	
15	多段速端子 4	
16	加减速时间选择端子 1	通过使用这两个端子的四种状态，可以选择四种加减速时间。
17	加减速时间选择端子 2	
20	运行命令切换端子	当命令源设置为端子控制 (P0.02=1) 时，该端子可以在端子控制和键盘控制之间切换。 当命令源设置为通信控制 (P0.02=2) 时，该端子可以在通信控制和键盘控制之间切换。
36	外部停止端子	在控制面板模式下，端子用于停止 VSM，相当于键盘上 STOP 键的功能。
47	紧急停车	当该端子生效时，驱动器会在最短的时间内停止。在停止过程中，电流保持在电流上限。该功能用于满足在紧急状态下停止驱动器的要求。

4 个多段端子可以组合成 16 种状态。这 16 个状态对应于 16 个命令集值，如下表所示。

表 24

4	3	2	1	命令	功能码
OFF	OFF	OFF	OFF	多段命令 0	PC.00
OFF	OFF	OFF	ON	多段指令 1	PC.01
OFF	OFF	ON	OFF	多段命令 2	PC.02
OFF	OFF	ON	ON	多段命令 3	PC.03
OFF	ON	OFF	OFF	多段命令 4	PC.04
OFF	ON	OFF	ON	多段命令 5	PC.05
OFF	ON	ON	OFF	多段命令 6	PC.06
OFF	ON	ON	ON	多段命令 7	PC.07
ON	OFF	OFF	OFF	多段命令 8	PC.08
ON	OFF	OFF	ON	多段命令 9	PC.09
ON	OFF	ON	OFF	多段命令 10	PC.10
ON	OFF	ON	ON	多段命令 11	PC.11
ON	ON	OFF	OFF	多段命令 12	PC.12
ON	ON	OFF	ON	多段命令 13	PC.13
ON	ON	ON	OFF	多段命令 14	PC.14
ON	ON	ON	ON	多段命令 15	PC.15

当电机频率源选择为多段命令时，功能码 PC.00-PC.15 的 100.0% 对应于功能码 P0.10 设置的最大频率。

除了多段速度命令外，多段命令还可以用作内置简易 PLC 和过程 PID 的给定源。

两个加减速时间选择端子可以组合成四种状态，这四种状态对应四种加减速时间设置，如下表所示。

表 25

2	1	命令设置	功能码
OFF	OFF	加速时间 1	P0.17、P0.18
OFF	ON	加速时间 2	P8.03、P8.04
ON	OFF	加速时间 3	P8.05、P8.06
ON	ON	加速时间 4	P8.07、P8.08

2. STO1 和 STO2 输入端子功能说明如下表所示。

表 26

设定值	功能	描述
56	STO 端子功能选择	对应端子与公共端断开，STO1 打开，面板显示“STO1”；
57		对应端子与公共端断开，STO2 打开，面板显示“STO2”；

3. 功能码 P4.10 用于设置输入端子的软件过滤时间。如果输入端子受到干扰，可能导致故障，请增加该参数的值以增强抗干扰能力。然而，较长的滤波时间会降低输入端子的响应。

表 27

范围	描述
P4.10 0.000 秒 -1.000 秒	数字输入滤波器时间

4. 功能码 P4.13-P4.22 用于设置模拟输入端子 FIV 电压值和 FIC 电流值对应的频率值，如下表所述。

表 28

范围	描述
P4.13 0- P4.15	设定模拟输入端子 1 最小值。默认为 FIV，电压 0V。
P4.14 -100%-(+100%)	设定模拟输入端子 1 最小值的相对值。默认为 0%。
P4.15 P4.13-10V	设定模拟输入端子 1 最大值。默认为 FIV，电压 10V。
P4.16 -100%-(+100%)	设定模拟输入端子 1 最大值的相对值。默认为 100%。
P4.17 0-10 秒	设定模拟输入端子 1 滤波时间。
P4.18 0-P4.21	设定模拟输入端子 2 最小值。默认为 FIC，电流 0mA。
P4.19 -100%-(+100%)	设定模拟输入端子 2 最小值的相对值。默认为 0%。

P4.20 P4.18-20 mA	设定模拟输入端子 2 最大值。默认为 FIC，电流 20mA。
P4.21 -100%-(+100%)	设定模拟输入端子 2 最大值的相对值。默认为 100%。
P4.22 0-10 秒	设定模拟输入端子 2 电压的滤波时间。

当 FIV 的模拟输入电压大于设定的最大输入（P4.15）时，模拟电压根据“最大输入”计算。同样，当模拟输入 FIV 电压小于设定的“最小输入”（P4.13）时，根据“FIV 低于最小输入设置选择”（P4.14）的设置，以最小输入相对值或者 0.0% 计算。

当模拟输入为电流形式时，1 mA 的电流相当于 0.5 V 的电压。模拟输入端子的滤波时间用于配置模拟输入信号的软件滤波持续时间。当现场模拟输入受到干扰时，增加滤波时间有助于稳定测量的模拟值。然而，较长的滤波时间会导致对模拟信号变化的响应速度变慢。适当的设置需要根据实际应用要求进行平衡。

2 个模拟输入端子可以按曲线 1 和曲线 2 两种形式设置，区别是曲线 1 没有负值频率。端口 FIV 可通过功能码 P4.33 的个位设置选择曲线形式，端口 FIC 可以通过功能码 P4.33 的十位设置选择曲线形式。

表 29

范围	描述
P4.33 个位设置	1 FIV 选择曲线 1。默认状态。
	2 FIV 选择曲线 2。
十位设置	1 FIC 选择曲线 1。
	2 FIC 选择曲线 2。默认状态。

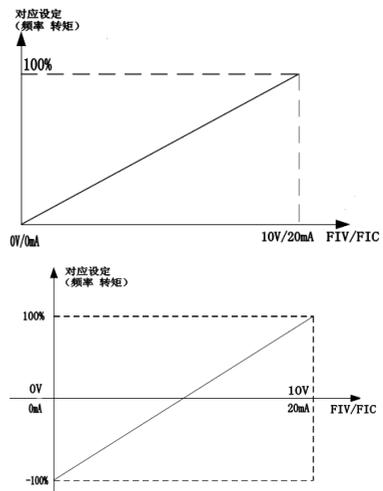


图 11

2个模拟输入端子电压电流的选择可以通过功能码 P4.40 的个位和十位设置，如下表所示。

表 30

范围	描述
P4.40 个位设置	0 模拟输入端子为 FIV。默认状态。
	1 模拟输入端子为 FIC。
十位设置	0 模拟输入端子为 FIV。
	1 模拟输入端子为 FIC。默认状态。

7.5 P5 组：输出端子

VSM 配备 1 个集电极输出端子 DO、1 个多功能继电器输出端子 RA-RB-RC 和 1 个多功能模拟输出端子 FOV。

1. 集电极输出端子 DO 和多功能继电器输出端子 RA-RB-RC 的功能码定义如表所示。DO 端子是一种可编程多路复用端子，可作为集电极开路的开关输出端子，相当于第二路继电器输出。

表 31

范围	描述
P5.00	1 开关输出 (DOR)
P5.01	1-40 DOR 输出功能选择
P5.02	1-40 继电器输出功能选择 (RA-RB-RC)

DOR 和继电器输出每个设定值的功能如下表所示。

表 32

设定值	功能	描述
0	无输出	输出端子没有功能。
1	运行中	当 VSM 运行时，输出 ON 信号。
2	故障停机	如果 VSM 因故障而发生故障并停机，则输出 ON 信号。
5	零速运行 (停止时无输出)	当 VSM 运行且输出频率为 0 时，输出 ON 信号。当机器处于停机状态时，信号为 OFF。
6	电机过载预报报警	VSM 过载保护动作前，根据过载预告的阈值进行判断，超过预告警阈值后输出 ON 信号。
7	变频器过载预报报警	VSM 过载保护发生前 10 秒，输出 ON 信号。
11	PLC 循环完成	当简单 PLC 运行一个周期时，输出一个宽度为 250ms 的脉冲信号。
12	累计运行时间已达到	当 VSM 的累计运行时间超过 P8.17 中设定的时间时，输出 ON 信号。
13	频率限制中	当设定频率超过频率上限或下限，且 VSM 输出频率也达到频率上限或下限时，输出 ON 信号。
14	转矩限定中	在速度控制模式下，当输出转矩达到转矩限定值时，VSM 处于失速保护状态，同时输出 ON 信号。

15	运行准备就绪	当 VSM 主电路和控制电路的电源已经稳定，VSM 未检测到任何故障信息时，VSM 处于工作状态，并输出 ON 信号。
16	FIV>FIC	当模拟输入 FIV 的值大于 FIC 的输入值时，输出 ON 信号。
17	达到上限频率	当工作频率达到上限频率时，输出 ON 信号。
18	达到下限频率 (关断时无输出)	当工作频率达到下限频率时，输出 ON 信号。在关断状态下，信号为 OFF。
19	欠压状态输出	当 VSM 处于欠压状态时，输出 ON 信号。
20	通信设置	请参考通信协议。
23	零速运行 (即使停止也能输出)	当 VSM 输出频率为 0 时，输出 ON 信号。在关机状态下，信号为 ON。
24	累计上电时间达到	当 VSM 的累计上电时间 (P7.13) 超过 P8.16 设定的时间时，输出 ON 信号。
26	频率 1 到达输出	请参考功能码 P8.30 和 P8.31 的说明。
28	电流 1 到达输出	请参考功能码 P8.38 和 P8.39 的说明。
30	定时到达输出	当定时功能选择 (P8.42) 有效时，VSM 在达到指定时间后输出 ON 信号。
32	失载	当 VSM 失去负载时，输出 ON 信号。
33	反向运行中	当 VSM 反向运行时，它会输出一个 ON 信号
35	模块温度到达	当驱动模块的散热器温度 (P7.07) 达到设定的模块温度值 (P8.47) 时，输出 ON 信号。

2. 模拟输出 FOV 以电压 0-10V 或电流 0-20mA 的形式输出。其中，通过功能码 P5.07 选择 FOV 输出特定功能。

表 33

范围	描述
P 5.07	0-15 FOV 输出功能选择

FOV 模拟输出功能的选择和配置如下表所示。

表 34

设定值	功能	描述
0	运行频率	0 ~ 最大输出频率
1	设定频率	0 ~ 最大输出频率
2	输出电流	0 ~ 2 倍电机额定电流
3	输出转矩	0 ~ 2 倍电机额定转矩
4	输出功率	0 ~ 2 倍额定功率
5	输出电压	0 ~ 1.2 倍变频器额定电压
7	FIV	0V ~ 10V
8	FIC	0V ~ 10V (或者 0 ~ 20mA)
15	运行频率	0 ~ 最大输出频率

7.6 P6 组：启停控制

1. 启停控制

默认情况下，启动直流制动时间设置为 0。VSM 直接从启动频率开始。如果启动直流制动时间不为 0，则先进行直流制动，然后从启动频率开始运行。直接启动和启动频率功能码设置如下。

表 35

范围	描述
P6.00	0 直接启动
P6.03	0-10Hz 启动频率
P6.04	0.0-100.0 秒 启动频率保持时间

为保证启动时的电机转矩，请设定合适的启动频率。为使电机启动时充分建立磁通，需要启动频率保持一定时间。

启动频率 P6.03 不受频率下限的限制。但是，如果目标频率小于启动频率，则 VSM 不会启动并处于待机模式。

正反切换过程中，启动频率保持时间不起作用。启动频率保持时间不包含在加速时间内，但包含在简易 PLC 的运行时间里。

示例 1:

P0.04=0，给定频率源为数字设定
 P0.10=2.00Hz，数字设定频率为 2.00Hz
 P6.03=5.00Hz，启动频率为 5.00Hz
 P6.04=2.0s，启动频率保持时间为 2.0s，逆变器将处于待机模式，逆变器输出频率为 0.00Hz。

2. 减速停车

VSM 停机模式由减速停止和自由停车两种模式组成，由功能码 P6.10 设置。

表 36

范围	描述
P6.10	0 减速停车
	1 自由停车

减速停止是指在发出停机命令后，VSM 根据减速时间降低输出频率，并在频率降至 0 后停止。

自由停止是指在发出关机命令后，VSM 立即终止输出，电机根据机械惯量自由停止。

3. 启动过程和停止过程的频率

VSM 启停过程的频率变化由功能码 P6.07 设置。

表 37

范围	描述
P6.07	0 线性加减速
	1 S 曲线加减速 A

线性加减速：输出频率按照直线递增或递减。DM2 提供 4 种类型的加速和减速时间。可通过数字输入端子（P4.00-P4.07）选择。

S 曲线加减速 A：输出频率根据 S 曲线增加或减少。S 型曲线用于需要平稳启动或停止的地方，如电梯、传送带等。功能码 P6.08 和 P6.09 分别定义了 S 曲线加速和减速的起始段和终点段的时间比例。

表 38

范围	描述
P6.08	0.0%- (100.0%-P6.09) S 曲线开始时间的刻度
P6.09	0.0%- (100.0%-P6.08) S 曲线结束时间的刻度

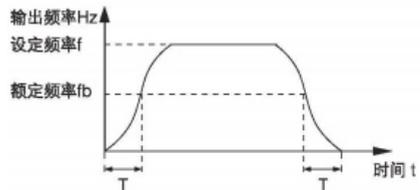


图 12 S 曲线加减速示意图 A

7.7 P7 组：控制面板和显示

1. VSM 控制面板的 STOP/RESET 键可以通过功能码 P7.02 进行设置，以选择不同的功能。默认值为 1，如下表所示。

表 39

范围	描述
P7.02	0 STOP/RESET 键的停止功能仅在控制面板模式下有效
	1 STOP/RESET 键的停止功能在任何作模式下都有效。默认设置。

2. VSM 速度显示与输出频率的对应关系由 P7.06 参数修改。

表 40

范围	描述
P7.06	0.0001-6.5000 速度显示系数

3. VSM 逆变器模块 IGBT 温度显示通过 P7.07 查看，累计运行时间通过 P7.09 查看，控制板软件版本显示在 P7.11，累计上电时间显示在 P7.13，累计功耗通过 P7.14 查看。

表 41

范围	描述
P7.07	0 - 120.0° C 显示逆变器模块的散热器温度
P7.09	0 - 65535 小时 显示累计运行时间
P7.11	/ 显示控制板软件版本
P7.13	0 - 65535 小时 显示累计开机时间
P7.14	0 - 65535 kW-h 显示累计功耗

7.8 其他功能码

其他功能码描述如下表所示，如果用户对功能码没有很好的理解，或者不知道如何设置功能码，请联系 ABB。

表 42

功能组	描述
P8 组	点动频率、辅助加减速时间、跳频、正反转死区时间、累计上电时间设置、启动保护、频率到达检测、定时功能等。
P9 组	故障和保护
PA 组	过程控制 PID 功能
PC 组	多端命令和简单的 PLC 功能
PD 组	通信参数
PP 组	密码功能
DO 组	监控参数

7.9 密码保护功能码

P1, P2, P8, P9, PA, PC, PD 和 PP 功能码参数受密码保护，只能在正确输入密码后显示，修改。如果想要修改相关参数（例如，简易 PLC、过程 PID、MODBUS RS-485、密码参数、PWM 控制优化 ...），请联系 ABB。

8. 故障与保护

VSM 具有多项警告和保护功能。一旦发生故障，保护功能启动，VSM 停止运行，故障代码显示在驱动器显示面板上。

ABB 可能要求提供更多信息来确定某些型号是否适合在特殊应用中使用或需要做特殊的设计修改。

8.1 电气保护

8.1.1 电机过载保护

VSM 过载保护功能码为 P9.00，默认设置为 1。根据电机过载保护的反时限曲线，VSM 将判断电机是否过载。反时限曲线如下：如果电机额定电流的 195% 保持 $1 \times (P9.01)$ 分钟，则触发电机过载故障报警。如果电机额定电流的 150% 保持 $5 \times (P9.01)$ 分钟，则会触发电机过载警报。

如果 VSM 过载，控制面板将显示 OL1 代码。

表 43

范围	描述
P9.00	0 电机过载保护被禁用
	1 电机过载保护已启用。默认设置。
P9.01	0.20-10.00 电机过载保护增益

注意

如果未启用过载保护，则可能存在过热和损坏电机的危险。建议用户保留出厂过载保护设置。

8.1.2 上电输出，运行接地故障保护

默认情况下，功能码 P9.07 设置为 1。VSM 检测电机通电时是否对地短路。如果没有短路，VSM 工作正常。

表 44

范围	描述
P9.07	0 对地短路保护被禁用
	1 使能对地短路保护。默认设置。

如果发生电机对地短路故障，在控制面板上会显示 GND 代码。

8.1.3 输入 / 输出缺相保护

输入缺相保护的功能码为 P9.12，默认设置为 1。输出缺相保护的功能码为 P9.13，默认设置为 1。

当输入缺相保护发生时，控制面板上显示 LI 代码。输出缺相保护发生时，控制面板上会显示 LO 代码。

表 45

范围	描述
P 9.12	0 禁止输入缺相保护
	1 允许输入缺相保护。默认设置。
P9.13	0 禁止输出缺相保护
	1 允许输出缺相保护。默认设置。

8.1.4 电机过热保护

电机过热保护只有在 PT100 安装在电机内部时才有效，该功能是客户选配。如果用户需要将 PT100 热敏电阻信号发送到上级控制系统，可以将 PT100 端子电缆连接到上级控制系统的相应端口。PT100 热敏电阻的最大测量电压为 2.5V，最大测量电流为 5mA。使用较高的测量电压或电流可能会导致读数不正确或损坏系统。将 PT100 连接到控制系统时，请确保提供足够的绝缘或隔离，请参考 IEC60664。

表 46

	范围	描述
P9.56	0	禁用 PT100 功能。默认设置。
	1	打开 PT100 功能
P9.57	0 - 200° C	电机报警温度设置。默认设置为 120° C。

8.1.5 驱动器过热保护

如果逆变器模块散热器温度超过出厂设置，则控制面板将显示 OH 代码。

8.1.6 过压 / 欠压保护

欠压保护设置的功能码为 L5.06，默认设置为 350V。当发生欠压保护时，作面板上会显示 LU 代码。过电压保护设置的功能码为 L5.09，默认设置为 820V。当加速过程中发生过压保护时，控制面板上会显示 OU1 代码。同理，在减速过程中显示 OU2 代码，在匀速过程中显示 OU3 代码。

表 47

	范围	描述
L5.06	350 - 820V	设置 驱动器 欠压故障。默认设置为 350V。（直流母线电压）。
L5.09	350 - 820V	设置 驱动器 过压故障。默认设置为 820V。（直流母线电压）。

8.2 飞车启动

VSM 具有飞车启动能力，能在电机轴有初始速度的情况下启动。然而，这种飞车启动能力仅支持低于额定速度三分之一的初始速度。当初速超过额定转速的三分之一时，会发生过压保护。

8.3 电磁兼容

为了提供适当的接地并确保符合当前的 EMC 要求，强烈建议对称屏蔽电缆（VFD 电缆）用于功率小于 30 kW 的电机。在所有电缆入口处实施 360° 接地连

接。将电缆屏蔽层拧成束并连接到 VSM 最近的接地端子 / 母线。

VSM 按照 EN IEC 61800-3:2023 标准（可调速电力驱动系统第 3 部分：PDS 和机床的 EMC 要求和特定测试方法）进行测试，所有测试项目均符合标准要求并通过测试。

基本高频（150kHz~30MHz）发射测试幅值符合 C3 类限制要求，如需符合 C2 类限制要求，可外接滤波器。基本低频（< 150kHz）发射的谐波或间谐波含量符合 C3 类要求，如需符合 C2 类要求，可外接电抗器。

VSM 外接滤波器和交流电抗器推荐型号如下：

表 48

机座号	滤波器	交流电抗器
71	EN360-20S	ACR-0010-2M40-0.78C
80	EN360-20S	ACR-0010-2M40-0.78C
90	RF14C20N6P	ACR-0020-1M40-0.45C

注意

根据 IEC/EN 61800-3，在 C3 类型下，VSM 供电不与低压公共网络配电系统连接，当 VSM 供电与低压公共配电网络连接时，为了满足 IEC 61000-3-2/12 标准中总谐波电流含量 THDI 要求，需要外接电抗器。

8.4 工作速度

当速度高于铭牌或相关产品目录中给出的标称速度时，控制面板会显示 oSP 代码。

重要的是要确保工作速度不超过电机的最大允许速度或整个应用的临界速度。

警告

不要超过电机的最大允许速度。请参考产品手册或铭牌信息。

8.5 故障复位

VSM 出现故障后，控制面板会显示相关的故障信息。用户可以通过键盘上的 STOP 键或端子功能（P4 组）复位故障。故障复位后，VSM 将处于待机模式。如果 VSM 处于故障状态，用户不进行故障复位，则 VSM 将保持运行保护状态，无法运行。

9. 维护

表 49

9.1 常规检查

1. 定期对 VSM 进行检查，每年至少检查一次。检查的频率取决于如环境空气湿度等当地气候条件。刚开始时可通过多次实验确定检查频率，之后严格遵守。
2. 保持 VSM 清洁，并确保空气自然流通。如果在灰尘过多的环境中使用 VSM，则必须定期检查和清洁通风系统。
3. 检查轴密封件（例如，V 形环或径向密封件）的情况，必要时更换密封件。
4. 检查连接件以及安装和组装螺栓的情况。
5. 通过监听是否存在不正常的噪音、振动测量、轴承温度测量，检查润滑脂的消耗量或 SPM 轴承监视来检查轴承情况。

当即将达到计算的轴承额定寿命时，应尤其注意。当出现磨损迹象时，拆卸电机，检查部件，必要时更换部件。在更换轴承时，备用轴承的型号必须与原安装的轴承型号完全相同，必须使用质量和特性均与原始密封件相同的密封件更换轴密封件。

当使用防护等级为 IP55 的电机，且电机在交付时已插入排水塞，则建议定期打开排水塞，以确保冷凝水通路不被堵塞，可以从电机中流出。必须在电机处于静止状态、可以安全工作时执行此操作。

9.2 润滑

警告
请留意所有转动部件！

轴承润滑间隔是电机可靠性的关键因素。

9.2.1 装有永久润滑轴承的电机

轴承通常采用 1Z、2Z、2RS 或同类永久润滑轴承。

下表给出了环境温度为 25°C 和 40°C 时，永久润滑轴承的工作时间。

根据 L_{10} 原则的润滑间隔时间

机座号	转速	25°C 时的工作时间	40°C 时的工作时间
71	4500	40000	38000
71	3000	40000	40000
71	1500	40000	40000
80	4500	38000	30000
80	3000	40000	32000
80	1500	40000	40000
90	4500	36000	25000
90	3000	40000	27000
90	1500	40000	40000

这些数值对产品目录中给出的允许荷载值有效。有关应用和负载条件，请参见适用的产品目录或联系 ABB。

立式电机的运行时间为以上数值的一半。

警告
不得超出润滑脂和轴承的最高工作温度 +110°C。不得超出电机设计的最高转速。

10. 售后支持

10.1 备件

订购备件时，必须指明电机序列号、完整的型号名称和产品代码，如铭牌所示。

有关更多信息，请访问网站 www.abb.com。

10.2 绕组重绕

应由合格的修理厂进行重绕绕组。如需对烟道电机和其它专用电机进行重绕绕组，请事先联系 ABB 公司。

10.3 轴承

拆装轴承时必须特别小心。轴承必须用‘起拔器’拆卸，安装时必须预热或使用专用工具。

轴承的更换方法在单独的说明书中有详细说明，该说明书可向 ABB 销售处索取。

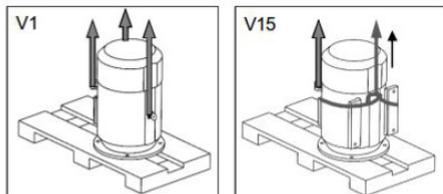
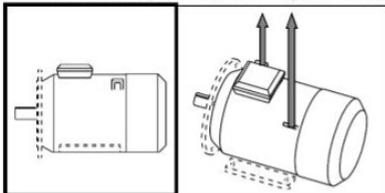
吊装指导手册

警告

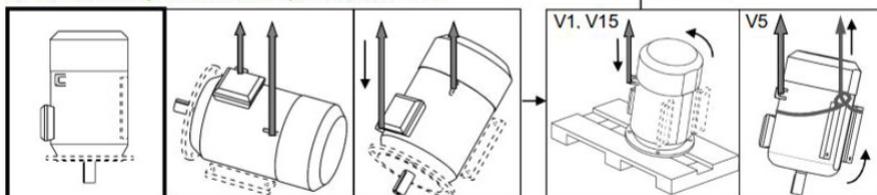
电机吊装处理不当可能会造成严重的人员伤亡或财产损失。只有具备相关资质的人员才能进行吊装及安装电机等操作。

吊装前：检查起吊设备并注意重量！电机实际重量显示在铭牌上。

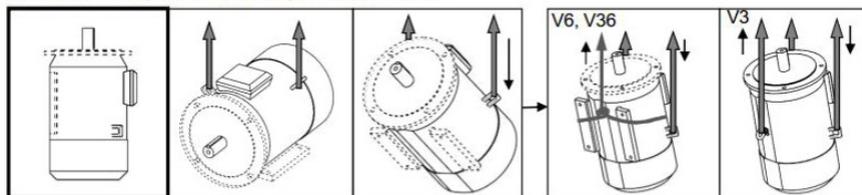
IM B3/ IM 1001, IM B5/IM3001, IM B35/IM2001



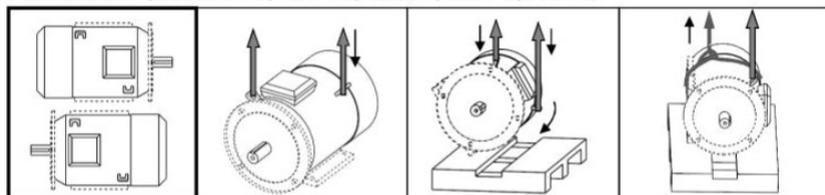
IM V5/ IM 1011, IM V1/IM3011, IM V15/IM2011



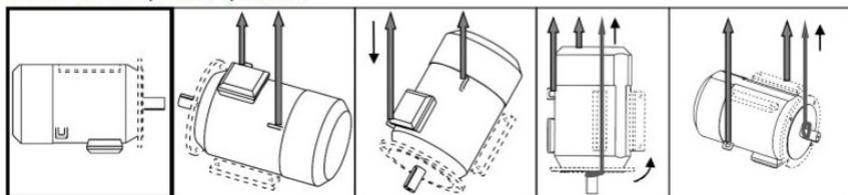
IM V6/ IM 1031, IM V3/IM3031, IM V36/IM2031



IM B6/ IM 1051, IM B7/1061, IM 3051, IM3061, IM2051, IM2061



IM B8/ IM 1071, IM3071, IM2071



Appendix A

Information for users, waste treatment facilities and marking

This document is prepared according to EU Directive 2012/19/EU (WEEE) to give endusers the necessary information on how to 'treat and dispose of EEE (Electrical and Electronic Equipment) waste after it has been removed from service and is to be recycled.

Marking of the products

Products that are marked with the crossed-out wheeled bin symbol as below and/or the symbol is included in its documentation shall be handled in the following way:



For private households

The crossed-out wheeled bin symbol on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste. For proper treatment, recovery and recycling, please take this product(s) to designated collection points where it will be accepted free of charge.

Alternatively, in some countries, you may be able to return your products to your local retailer upon purchase of an equivalent new product.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which might otherwise arise from inappropriate waste handling.

Please contact your local authority for further details of your nearest designated collection point. Depending on your national legislation, incorrect disposal of this waste may incur a penalty in your country.

For professional users in the European Union

The crossed-out wheeled bin symbol on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste, If you wish to dispose of electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

For disposal in countries outside the European Union

The crossed-out wheeled bin symbol is only valid in the European Union (EU) and means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste. If you wish to dispose of this product, please contact your local authorities or dealer for the correct method of disposal.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

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1. Introduction

Note

These instructions must be followed to ensure safe and proper installation, operation and maintenance of the machine. These instructions should be brought to the attention of anyone who installs, operates or maintains the machine or associated equipment. The machine is intended for installation and use by qualified personnel, familiar with health and safety requirements and national legislation. Ignoring these instructions may invalidate all applicable warranties.

1.1 ABB LV Titanium variable speed motor information

The ABB LV Titanium variable speed motor, or “VSM”, is a three-phase permanent magnet motor integrated with variable frequency drive. The machine parameters are listed on the nameplate, including bearing size, drive information, weight, system efficiency, etc.

1.2 Conditions

- The normal range of ambient temperature is -20° C to +50° C. Needs de-rating above 40° C.
- The maximum altitude is 2000m. Needs de-rating above 1000m.
- Ambient relative humidity of up to 95% with no condensation.
- The input voltage tolerance of the drive is 380-480V (+10/-15%), and the frequency is 47-63Hz.
- Nameplates give the rating and working conditions.

VSMs can only be used in applications that meet the above criteria. In addition, all requirements in this manual, other relevant instructions and standards must be followed.

Please contact ABB with any need for different operating limits.

WARNING

Failure to follow instructions or equipment maintenance may create safety hazards. Do not use the machine in this case.

1.3 Declaration of Conformity

The conformity of the product according to Directive 2006/42/EC (Machinery) must be established by the commissioning party when the motor is fitted to the machinery.

VSMs are intended for use as components for industrial and commercial installations as defined in the Machinery Directive (MD) 89/392/EEC. Commissioning is prohibited until the conformity of the product with this directive has been established (follow local safety and installation rules e.g. EN 60204).

These machines comply with the harmonized series of standards EN 60034 / DIN VDE 0530. Their use in hazardous areas is prohibited unless they are expressly designed for such use.

1.4 VSM Noise

At rated frequencies, most ABB motors have noise levels below 82dB(A).

2. Terms and abbreviations

Table 1

Term	Definition
VSM	ABB LV Titanium variable speed motor
Drive	Frequency converter for controlling AC motors
X1, X2, X3, X4	Digital input terminal
DO	Digital output terminal
STO1, STO2	Safety torque off terminal
FI	Analog input
FIV	Analog input terminal; interface for analog voltage input signals
FIC	Analog input terminal; interface for analog current input signals
FO	Analog output
FOC	Analog output terminal; interface for analog output signals
EMC	Electromagnetic compatibility
ID run	Motor identification run.
PID	Proportional–integral–derivative
PMSM	Permanent magnet synchronous motor

PLC	Programmable logic controller
SIL	Safety integrity level.
PDS	Powe drive system
C3	Rated input voltage less than 1000V, intended for use in an industrial location and not intended for use in a residential, commercial or light industrial location.
C2	Rated input voltage less than 1000V, which is neither a plug-in device nor a movable device and which is not intended for use in a residential location.
THD	Total harmonic distortion

different center of gravity because of different output, mounting arrangements, or auxiliary equipment.

Damaged lifting lugs must not be used. Check that eyebolts or integrated lifting lugs are undamaged before lifting.

Ensure that proper lifting equipment is used and that the sizes of the hooks are suitable for the lifting lugs.

3. Handling

3.1 Initial check

Immediately inspect the VSM upon receipt.

- Verify the parameters match the order information.
- Check for any external damage (shaft-ends, flanges, painted surfaces, control panel, ...) and if found, inform the forwarding agent without delay.

3.2 Transportation and storage

The motor should always be stored indoors (above -20°C), in dry, vibration free and dust free conditions.

During transportation, shocks, falls and humidity must be avoided.

The motor must not be subject to any external vibrations at standstill to avoid causing damage to the bearings.

3.3 Lifting

All ABB motors above 25 kg are equipped with lifting lugs or eyebolts.

Only the main lifting lugs or eyebolts of the motor should be used for lifting the motor.

Terminal boxes must not be used for lifting the motor.

Motors with the same frame may have a

4. Mechanical Installation and commissioning

WARNING

Disconnect and lock out before working on the VSM or the driven equipment.

4.1 General

WARNING

In case of vertically mounted motors, the user is responsible for preventing any water or liquids running down the shaft. Remove transport lock if employed. Turn the shaft by hand to check for free rotation.

4.2 Foundation

The user has full responsibility for the preparation of the foundation.

Metal foundations should be painted to avoid corrosion.

Foundations must be even, see figure below, and sufficiently rigid to withstand possible short circuit forces. They must be designed and dimensioned to avoid the transfer of vibration to the motor and to avoid vibration caused by resonance.

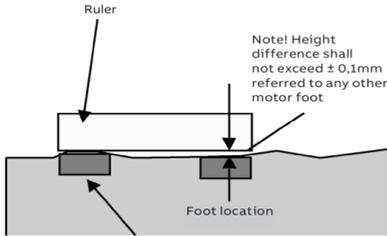


Figure 1

4.3 Balancing and fitting couplings and pulleys

As standard, balancing of the motor has been carried out using half key.

When balancing with full key, the shaft is marked with YELLOW tape, with the text “Balanced with full key”.

In case of balancing without key, the shaft is marked with BLUE tape, with the text “Balanced without key”.

Couplings or pulleys must be balanced after machining the keyways. Balancing must be done in accordance with the balancing method specified for the motor. Coupling halves and pulleys must be fitted on the shaft by using suitable equipment and tools which do not damage the bearings and seals.

Never fit a coupling half or pulley by hammering or by removing it using a lever pressed against the body of the motor.

4.4 Mounting and alignment of the motor

Ensure there is enough space for free airflow around the motor. Minimum requirements for free space behind the motor fan cover can be found in the product catalog or from dimension drawings available from the web: www.abb.com. Correct alignment is essential to avoid noise, vibration and machine failures.

Mount the motor on the foundation using the appropriate bolts or studs. Place shims as needed between the foundation and the feet.

Align the motor using appropriate methods.

If applicable, drill locating holes and fix the locating pins into position.

Mounting accuracy of couplings: check that clearance b is less than 0.05 mm and that the difference $a1$ to $a2$ is also less than 0.05 mm. See Figure below.

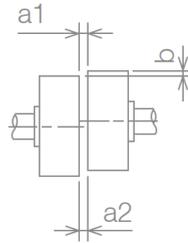


Figure 2 Mounting of half-coupling or pulley

Re-check the alignment after final tightening of the bolts or studs.

Do not exceed the permissible loading values for bearings as stated in the product catalogues.

4.5 Slide rails and belt drives

Fasten the motor to the slide rails as shown below.

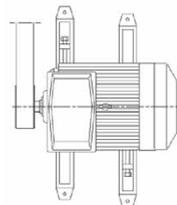


Figure 3 Belt drive

Place the slide rails horizontally on the same level. Check that the motor shaft is parallel with the drive shaft.

Belts must be tensioned according to the instructions of the supplier of the driven equipment. However, do not exceed the

maximum belt forces (i.e. radial bearing loading) stated in the relevant product catalogues.

WARNING

Excessive belt tension will damage bearings and can cause shaft damage.

4.6 Machines with drain plugs for condensation

Check that drain holes and plugs face downwards.

Machines with sealable plastic drain plugs are delivered in an open position. In very dusty environments, all drain holes should be closed.

5. Electrical installation

5.1 Insulation resistance check

Note

Do not perform voltage withstand or insulation resistance tests on the VSM. The tests can cause damage to the drive. Each drive and motor are tested for insulation between the main circuit and the frame at the factory. Also, there are voltage-limiting circuits inside the drive which cut down the testing voltage automatically.

Before you connect the input power cable to the drive, measure its insulation resistance according to local regulations.

5.2 Cable laying and electrical connection

5.2.1 Cable entry sealing requirements

VSM cable entries are metrically threaded, and the IP rating of the cable glands must be at least the same as that of the VSM.

WARNING

Depending on the cable type and diameter, use suitable cable glands and their seals in the cable entry.

5.2.2 Grounding requirements

Before connecting the VSM to the power supply, grounding must be carried out in accordance with local regulations. The VSM supports two grounding methods: three-phase TN and three-phase TT.

Unless local wiring regulations state otherwise, the cross-sectional area of the protective earth conductor must agree with the conditions that require automatic disconnection of the supply required in 411.3.2 of IEC 60364-4-41:2005 and be capable of withstanding the prospective fault current during the disconnection time of the protective device.

5.2.3 Main circuit connection

The main circuit wiring can be connected to peripheral devices such as breaker, contactors, and AC reactors before being linked to the VSM.

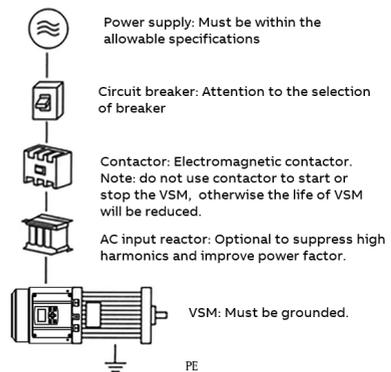


Figure 4

The VSM's junction box contains three input power terminals for grid connections. See figure below.



Figure 5

5.2.4 Control terminals connection

In addition to the power supply input terminals, there is also a row of signal control terminals. See figure 6 below.

The basic wiring diagram of the control terminals is shown in the figure below.

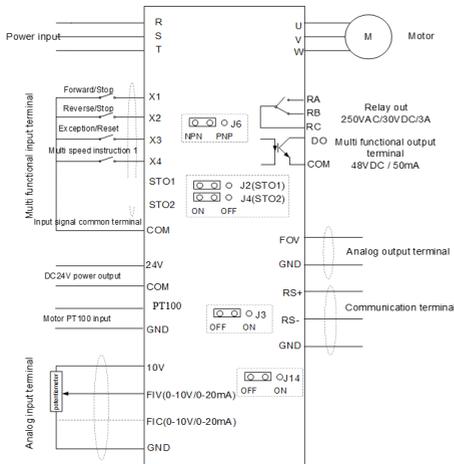


Figure 7 Wiring diagram of the control terminals

Table 2

Terminal	Description
X1, X2, X3, X4	Digital input terminals are valid when connected with COM terminal. When used in conjunction with the P4.00-P4.03 function codes on the control panel, these digital input terminals can send digital commands to VSM. For more details, please refer to Section 7.4.
STO1, STO2	Safety torque off terminals. For more details, please refer to Section 7.4.
FOV	Analog output terminal is effective when connected with GND. When used in conjunction with the function codes P5.07 to P5.08 on the control panel, this output terminal can output a voltage ranging from 0 to 10V or a current ranging from 0 to 20mA. For more details, please refer to Section 7.5.
FIV, FIC	Analog input terminals are effective when connected with a 10V power supply. When used in conjunction with the function codes P4.13 to P4.23 on the control panel, they can send voltage signals ranging from 0V to 10V or current signals ranging from 0mA to 20mA to the VSM. For more details, please refer to Section 7.4.
PT100/GND	thermistor input port, used in conjunction with the function codes P9.56 to P5.57 on the control panel, it enables motor overheating protection. For more details, please refer to Section 8.1.2.
DO	Multifunctional optocoupler output terminal, used in conjunction with the function codes P5.01 to P5.03 on the control panel. For more details, please refer to Section 7.5.
RA, RB, RC	RC is the common terminal for the two relay outputs RA and RB. RA is a normally open output port. RB is a normally closed output port. These relay ports are used in conjunction with the function codes P5.01 to P5.03 on the control panel. For more details, please refer to Section 6.5.
RS+/RS-	RS-485 communication terminals.

5.2.5 Cable requirements

It is recommended to use symmetrical shielded cables (VFD cables) for the main circuit wiring. The wire diameter requirements are related to the power and are as follows.

Table 3

Power (kw)	Current (A)	Section (mm ²)
1.5-2.2	2-4	1.5
3-4	5-8	2.5
5.5-7.5	11-17	4
11-15	20-26	6
18.5-22	32-38	10
30	51	16



Figure 6 Signal control terminals

To prevent malfunction caused by interference, please use stranded shielded cables or double-shielded twisted pair cable for the control loop. It is recommended to choose a wire diameter of 0.3 to 0.5 mm².

6. Operation

6.1 Operational safety precautions

- Do not step on VSM.
- Be careful with the rotating parts of the motor.
- Warning, the VSM enclosure may be too hot to touch during normal operation and after shutdown.
- Do not open the junction box when the power is on
- Before starting the work, isolate the drive from all dangerous voltage sources, and verify it is safe to start the work.
- Wait for 20 minutes after you disconnect the input power to let the intermediate circuit capacitors discharge.
- Special instructions are required for the use of VSMs in special applications (e.g., using an inverter power supply). Please contact ABB.

6.2 Introduction to the Control Panel Keyboard

The following is a schematic diagram of the control panel.



Figure 8

The following table describes the functions of the buttons on the control panel.

Table 4

Symbols	Name	Feature description
Menu	Menu	Enter or exit the first-level menu.
OK	OK	Enter menu sub-sections and confirm the parameters setting.
▲	UP increment	Increment values or function codes.
▼	DOWN decrement	Decreasing values or function codes.
▶	shift key	In the shutdown display interface and the running display interface, display parameters can be cyclically selected. When modifying parameters, the specific digits to be modified can be chosen.
Lo/Re	Local/remote toggle key	Lo means local control and Re means remote control. Press and hold for 3 seconds to switch between local and remote control.
Start	Run key	In keyboard mode, it is used to run actions.
Stop	Stop/reset key	When in the running state, pressing this key will stop the operation and is restricted by the function code P7.02. When in the fault alarm state, it can be used to reset the fault, which is not limited by the function code P7.02.

The internal parameters of the control panel are divided into three levels of menu parameters:

- First-level menu, such as P0.
- Second-level menu, such as P0.04.
- Third-level menu of parameter values, such as 150Hz.

In the third-level menu state, if the value cannot be changed, the possible reasons are:

- This function code is a parameter that cannot be modified, such as actual measured or calculated parameters during operation or values tracking past performance.
- The function code cannot be modified in the running state and can only be modified after shutdown.

6.3 Operation process and start-up

The VSM is initialized first after powering on and is in standby mode after initialization is complete.

If the user does not need to change any performance such as speed, the user can directly press the Start button on the keyboard, and the motor will accelerate to the rated speed of the nameplate.

If the user needs to adjust control commands like rotational speed, they can directly modify the parameters on the control panel according to the function code instructions.

Example: change function code P1.04 from 50.00 Hz to 40.00 Hz.

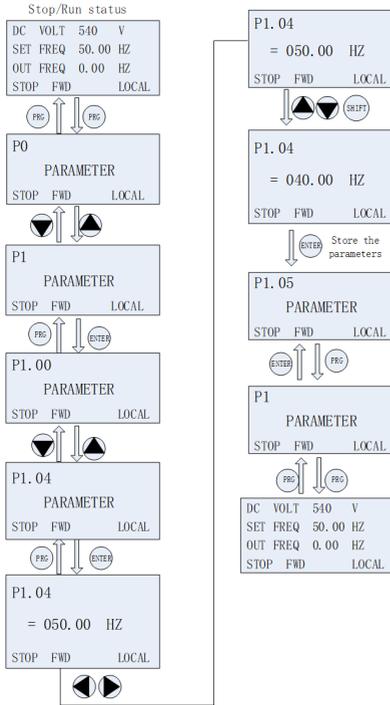


Figure 9

Note

The VSM is not configured with a start-up protection function upon leaving the factory. When powered on or after a fault reset, simultaneously the control port issues a start command, the motor will accelerate to the rated speed indicated on the nameplate. If the end user requires the start-up protection function, they can set it up according to the operating instructions for function code P8.18.

6.4 Remote operation

If preferred, instead of using the integrated panel on the VSM, users can remotely modify the VSM's control commands via the control terminals or an external control panel.

6.4.1. Remote control of control terminals

Before attempting remote control using control terminals, connects the terminals correctly according to section 5.2.4. Then set relevant function codes of the control terminals for remote control.

The control terminals can recognize analog instruction, digital instruction, and Modbus communication instruction.

6.4.2. Remote control by external control panel

The external control panel is connected to the RJ45 port in the VSM drive junction box, and its operation method is the same as that of the integrated control panel on the drive. The external control panel also has a wireless connection function to realize wireless remote control on the PC and mobile phone.

Note

The external control panel is available as an optional accessory, please contact ABB for purchase information.

6.5 Language selection

On the control panel, press and hold the OK key and the Stop key simultaneously to switch between Chinese and English languages.

7. Function Codes

7.1 P0 group: basic function codes

1. The VSM pre-programmed for two load modes, as shown in the following table. The function code P0.00 is set to 1 by default, that is, G type.

Table 5

	Range	Description
P0.00	1	G type (constant torque load type). Default state.

2. The VSM uses high-performance vector control without a speed sensor.

Table 6

	Range	Description
P0.01	0	Vector control without speed sensor (without PG)

3. The following table shows the VSM input control command selection. The default state of function code P0.02 is set to 0, so initial control commands must be input using the control panel. Control commands include start, stop, forward, reverse, jog, etc.

Table 7

	Range	Description
P0.02	0	Control panel command. Default state.
	1	Remote control terminals command
	2	RS-485 remote communication command channel

When the function code P0.02 is set to 1, the input control commands are determined by the control terminals. Refer to Section 7.4 for the relevant instructions of the P4 group.

When the function code P0.02 is set to 2, the input control commands are determined by the host computer through RS-485 communication. For more details, please contact ABB.

4. The motor frequency settings for the VSM are presented in the following table. By default, function code P0.03 is set to "1", which means the motor input frequency is configured through the control panel and will be retained as the preset frequency after a power outage.

Table 8

	Range	Description
P0.03	0	Panel setting (P0.08 preset frequency, UP/DOWN to modify, not stored with power-off).
	1	Panel setting (P0.08 preset frequency, UP/DOWN to modify, stored with power-off). Default state.
	2	Analog input terminal FIV
	3	Analog input terminal FIC
	6	Digital input multi-speed commands
	7	Built-in simple PLC
	8	Process PID
	9	RS-485 communication given

When the function code P0.03 is set to 2 or 3, the motor input frequency is determined by the analog input terminal. VSM provides 2 analog input terminals (FIV, FIC). Both FIV and FIC can read 0V-10V voltage input, or 4mA-20mA current input, upon selection by function code P4.40. Users can freely select the relationship between the input voltage values of FIV and FIC and the motor's target input frequency through function code P4.33.

When the function code P0.03 is set to 6, the motor speed is determined by the 4 digital input terminals that can be used to set up multi-speed commands. For more details, please refer to the relevant function parameters of the P4 group.

When the function code P0.03 is set to 7, the motor frequency is determined by the built-in simple PLC. When the simple PLC is used as the frequency source, the motor running speed and direction are determined by the multi-speed commands; the holding time and cycle times can also be set by users. For more information, please contact ABB.

When the function code P0.03 is set to 8, the motor frequency is determined by the "process PID control". Generally, it is used for on-site process closed-loop control, such as constant pressure or constant tension closed-loop control. The relevant parameters of the "PID function" of the PA group need to be set.

When the function code P0.03 is set to 9, the motor input frequency is determined by the

host computer through RS-485 communication and refers to the relevant instructions of the PD group.

5. When the frequency source function code P0.03 is set to a state of 0 or 1, the digital setpoint of function code P0.08 corresponds to the motor operated frequency. Additionally, the motor operated frequency set by function code P0.08 can be incremented or decremented by the digital input terminals "UP/DOWN". For specific details, please refer to the descriptions of the relevant functional parameters in Group P4.

Table 9

Range	Description
P0.08	5Hz-maximum frequency Motor operated frequency.

6. The function code P0.09 can change the motor rotation without changing the motor cables, and its function is equivalent to adjusting any two lines of the motor (U, V, W) to reverse the motor rotational direction.

Note

The motor running direction will return to its original state after the parameters are initialized.

Table 10

Range	Description
P0.09	0 The rotational direction is the same as the preset direction
	1 The rotational direction is opposite to the preset direction

7. When analog input, digital pulse input, multi-speed commands, etc., are used as frequency sources, their respective 100.0% reference levels are all calibrated relative to the value set in P0.10.

Table 11

Range	Description
P0.10	5Hz-599Hz The maximum frequency of motor operation

8. The upper frequency of the VSM can be either from the digital setting of the control panel (P0.12) or from the analog input terminal. When the upper frequency is set with an analog input, 100% of the analog input corresponds to value set in P0.12.

Table 12

Range	Description
P0.11	0 Function code P0.12 setting. Default state.
	1 Analog input terminal FIV
	2 Analog input terminal FIC
	5 RS-485 communication
P0.12	P0.14- P0.10 Set the upper limit frequency
P0.14	0.00Hz-P0.12 Set the lower limit frequency

For example, when applying constant torque control in winding applications, to prevent "runaway" caused by material breakage, an upper frequency limit value can be set via the analog input terminal. When the VSM reaches this maximum frequency, it maintains operation at frequency limit.

9. The carrier frequency of the VSM can be determined by the function code P0.15, which is 5kHz by default. By adjusting the carrier frequency, the motor noise can be reduced; the resonance point of the mechanical system can be avoided; the leakage current of the line to the ground can be reduced; and the interference caused by the inverter can be reduced.

Table 13

Range	Description
P0.15	0.5kHz-6kHz Carrier frequency. Default value is 5KHz.

10. The carrier frequency of the VSM can be adjusted with temperature, as determined by the function code P0.16. The default is 0, that is, carrier frequency does not adjust with temperature.

Table 14

Range	Description
P0.16	0 Does not adjust with temperature. Default state.
	1 Adjusts with temperature

11. The acceleration time and deceleration time of the VSM are respectively set by the function code P0.17 and P0.18 settings.

Acceleration time refers to the time required for the VSM to accelerate from 0Hz to the base frequency of acceleration and deceleration (determined by function code P0.25).

Deceleration time refers to the time required for the VSM to decelerate from the base frequency of acceleration and deceleration (determined by P0.25) to 0Hz.

Table 15

Range	Description
P0.17 0.00s-6500.0s	Acceleration time
P0.18 0.00s-6500.0s	Deceleration time

12. The VSM provides three acceleration and deceleration time units, which are 1 second, 0.1 second, and 0.01 second.

Table 16

Range	Description
P 0.16 P 0	1 second
1	0.1 seconds. Default state.
2	0.01 seconds

13. The acceleration and deceleration time reference frequency of the VSM can be determined by the function code P0.25. When 1 is selected, the acceleration and deceleration time is related to the set frequency. If the set frequency changes frequently, the acceleration of the motor is varied, and attention needs to be paid when applying.

Table 17

Range	Description
P 0.25 0	The base frequency of the acceleration and deceleration time is the maximum frequency (P0.10). Default state.
1	The base frequency of the acceleration and deceleration is the set frequency
2	The reference frequency of acceleration and deceleration time is 100Hz

14. The function code P0.27 is used to bind the three running command sources with the seven frequency sources, facilitating synchronous switchover.

The meaning of the motor frequency sources in P0.27 is the same as that in P0.03. Please refer to the description of function code P0.03. Different running command sources can be bundled with the same frequency reference source. If a running command source has a bound frequency source, the digital frequency source set in P0.03 will no longer work when the bound frequency source is enabled.

Table 18

Range	Description
P0.27 Default value	000
Unit's digit	Binding control panel command to frequency source
0	No binding
1	Frequency source from panel digital setting
2	FIV
3	FIC
6	Digital input multi-speed commands
7	Built-in simple PLC
8	Process PID
9	RS-485 communication given
Ten's digit	Binding terminal command to frequency source (0-9, same as unit's digit)
Hundred's digit	Binding communication command to frequency source (0-9, same as units digit)

7.2 P1 group: motor parameters

1. The motor parameters of VSM can be confirmed by P1.00-P1.05, which must be consistent with the motor parameters of nameplate.

Table 19

Range	Description
P1.00 2	Permanent magnet synchronous motor
P1.01 0.1-7.5kW	Rated power
P1.02 1-500V	Rated voltage
P1.03 0.01-13A	Rated current
P1.04 75Hz/150Hz/225Hz	Rated frequency
P 1.05 1500rpm / 3000rpm / 4500rpm	Rated speed

2. Function code P1.37 is used to set the VSM ID runs mode. The VSM initial ID run was completed at the factory.

Standstill mode is suitable for occasions where the motor is not easy to disconnect with load

and turning mode cannot be carried out. Before Standstill mode, the motor type and motor nameplate parameters (P1.01-P1.05) must be set correctly. The drive can obtain three parameters (P1.16-P1.18) by Standstill mode. Action description: Set the function code to 11, and then press the RUN button, the VSM will perform Standstill mode.

In the process of turning mode, the VSM first performs Standstill mode and then accelerates to 80% of the rated frequency of the motor according to the acceleration time (P0.17). After maintaining it for a certain period, it decelerates and stops according to the deceleration time P0.18 and ends the ID run. Action description: Set the function code to 12, and then press the RUN button, the VSM will perform dynamic self-learning.

Table 20

Range	Description	
P 1.37	0	No action
	11	Standstill mode
	12	Turning mode

Note

The motor parameters of VSM have been correctly set according to the nameplate before leaving the factory, and the ID operation has been completed.

7.3 P2 group: vector control function codes

When the VSM operates at different frequencies, different PI parameters for the speed control loop can be selected. When the operating frequency is lower than the switching frequency 1 (P2.02), the PI tuning parameters for the speed control loop are P2.00 and P2.01. When the operating frequency is higher than the switching frequency 2, the PI tuning parameters for the speed control loop are P2.03 and P2.04. For operating frequencies between switching frequency 1 and switching frequency 2, the PI parameters for the speed control loop are linearly switched between the two sets of PI parameters.

Table 21

Range	Description	
P2.00	1-100	Speed loop proportional Gain 1
P2.01	0.01-10.00s	Velocity loop integration time 1
P2.02	0.00-P2.05	Switching frequency 1
P2.03	1-100	Speed Loop proportional Gain 2
P2.04	0.01-10.00s	Velocity loop integration time 2
P2.05	P2.02 - maximum output frequency	Switching frequency 2

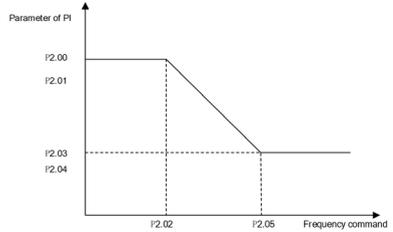


Figure 10

If the control parameters do not meet the application requirements, please contact ABB after-sales.

7.4 P4 group: input terminal

The VSM is equipped with 4 digital input terminals, 2 STO input terminals, and 2 analog input terminals. The function codes of the digital input terminal and the STO input terminal are defined in the table.

Table 22

Range	Description	
P4.00	0-50	X1 terminal function selection
P4.01	0-50	X2 terminal function selection
P4.02	0-50	X3 terminal function selection
P4.03	0-50	X4 terminal function selection
P4.06	57	STO2 terminal function selection
P4.07	56	STO1 terminal function selection

1. The functions that can be selected for each of the digital input terminals X1, X2, X3, and X4 are shown in the table below.

Table 23

Setpoint	Function	Description
1	Forward rotational operation	The VSM is controlled by an external terminal to rotate forward and reverse.
2	Reverse rotational operation	
6	UP Terminal	Increment and decrement commands to modify the frequency when the frequency is given by the external terminal. When the frequency source is set to digital, the set frequency can be adjusted up or down.
7	DOWN Terminal	
8	Coast to stop	The inverter blocks the output, and the shutdown process of the motor is not controlled by the inverter.
9	Fault reset	This function uses terminals to reset faults. The function is the same as the RESET key on the keyboard. This feature enables long-distance fault reset.
10	Run pause	The VSM decelerates to stop, but the running parameters are all memorized, such as PLC, swing frequency and PID parameters. After this function is disabled, the AC drive resumes its status before stopping.
12	Multi- segment terminal 1	The 16 states of these four terminals can be used to set 16 speed commands or 16 other commands.
13	Multi- segment terminal 2	
14	Multi- segment terminal 3	
15	Multi- segment terminal 4	
16	Acceleration and deceleration time selection terminal 1	By using the four states of these two terminals, four acceleration and deceleration times can be selected.
17	Acceleration and deceleration time selection terminal 2	
20	Run the command to switch terminals	When the command source is set to terminal control (P0.02=1), this terminal can switch between terminal control and keyboard control. When the command source is set to communication control (P0.02=2), this terminal can switch between communication control and keyboard control.
36	External stop terminals	In control panel mode, the terminal can be used to stop the inverter, which is equivalent to the function of the STOP key on the keyboard.
47	Emergency stops	When this terminal becomes effective, the drive stops within the shortest time. During the stopping process, the current remains at the current upper limit. This function is used to satisfy the requirement of stopping the drive in emergency state.

The 4 multi- segment terminals can be combined into 16 states. These 16 states correspond to 16 command set values, as shown in the following table.

Table 24

4	3	2	1	Command	Function codes
OFF	OFF	OFF	OFF	Multi-segment command 0	PC.00
OFF	OFF	OFF	ON	Multi-segment instruction 1	PC.01
OFF	OFF	ON	OFF	Multi-segment command 2	PC.02
OFF	OFF	ON	ON	Multi-segment command 3	PC.03
OFF	ON	OFF	OFF	Multi-segment command 4	PC.04
OFF	ON	OFF	ON	Multi-segment command 5	PC.05
OFF	ON	ON	OFF	Multi-segment command 6	PC.06
OFF	ON	ON	ON	Multi-segment command e7	PC.07
ON	OFF	OFF	OFF	Multi-segment command 8	PC.08
ON	OFF	OFF	ON	Multi-segment command 9	PC.09
ON	OFF	ON	OFF	Multi-segment command 10	PC.10
ON	OFF	ON	ON	Multi- segment command 11	PC.11
ON	ON	OFF	OFF	Multi- segment command 12	PC.12
ON	ON	OFF	ON	Multi- segment command 13	PC.13
ON	ON	ON	OFF	Multi- segment command 14	PC.14
ON	ON	ON	ON	Multi- segment command 15	PC.15

When the motor frequency source is selected as multi-segment command, 100.0% of function code PC.00-PC.15 corresponds to maximum frequency set by function code P0.10.

Besides the multi- segment speed commands, multi- segment commands can also be used as a given source of built-in simple PLC and process PID.

The two acceleration and deceleration time selection terminals can be combined into four states, and these four states correspond to four acceleration time or deceleration time settings, as shown in following table.

Table 25

2	1	Command settings	Feature codes
OFF	OFF	Acceleration time 1	P0.17、 P0.18
OFF	ON	Acceleration time 2	P8.03、 P8.04
ON	OFF	Acceleration time 3	P8.05、 P8.06
ON	ON	Acceleration time 4	P8.07、 P8.08

2. STO1 and STO2 input terminal function description is shown in the following table.

Table 26

Setpoint	Function	Description
56	STO terminal function	The corresponding terminal and the COM terminal are disconnected, STO1 is opened, and the panel displays "STO1";
57	selection	The corresponding terminal and COM terminal are disconnected, STO2 is opened, and the panel displays "STO2";

3. Function code P4.10 is used to set the software filter time of the input terminal. If the input terminals are exposed to interference which may cause malfunction, increase the value of this parameter to enhance the anti-interference capability. However, longer filter time will reduce the response of the input terminals.

Table 27

Range	Description
P4.10	0.000s-1.000s Digital Input filter time

4. Function codes P4.13-P4.22 are used to set the frequency values corresponding to the FIV voltage and FIC current values, as described in the table below.

Table 28

Range	Description
P4.13	0- P4.15 Set the minimum of the analog input 1. The default is FIV, with a voltage of 0V.
P4.14	-100% to +100% Set the relative value of the minimum (P4.13). The default is 100%.
P4.15	P4.13-10V Set the maximum of the analog input 1. The default is FIV, with a voltage of 10V.
P4.16	-100% to +100% Set the relative value of the maximum (P4.15). The default is 100%.
P4.17	0-10s Set the filtering time for the analog input 1.
P4.18	0- P4.21 Set the minimum of the analog input 2. The default is FIC, with a current of 0mA.
P4.19	-100% to +100% Set the relative value of the minimum (P4.18). The default is 100%.
P4.20	P4.18-20 mA Set the maximum of the analog input 2. The default is FIC, with a current of 20mA.
P4.21	-100% to +100% Set the relative value of the maximum (P4.20). The default is 100%.
P4.22	0-10s Set the filtering time for the analog input 2.

When the analog input voltage of the FIV is greater than the set "maximum input" (P4.15), the analog voltage is calculated according to the "maximum input". Similarly, when the analog input FIV voltage is less than the set "minimum input" (P4.13), it is calculated as the minimum input or 0.0% according to the setting of "FIV below minimum input setting selection" (P4.14).

When the analog input is in the form of current, 1 mA of current is equivalent to 0.5 V of voltage. Filtering time for analog input terminals is used to configure the software filtering duration for analog input signals. When on-site analog inputs are subject to interference, increasing the filtering time can help stabilize the measured analog values. However, a longer filtering time results in slower response to changes in the analog signals. The appropriate setting requires balancing based on actual application requirements.

Two analog input terminals can be set in two forms: Curve 1 and Curve 2, with the difference that Curve 1 does not have negative frequency values. The FIV can be selected through the unit's digit setting of function code P4.33, while the FIC can be selected through the ten's digit setting of function code P4.33.

Table 29

Range	Description	
P4.33	Unit's digit	1 FIV selects Curve 1. Default state. 2 FIV selects Curve 2.
	Ten's digit	1 FIC selects Curve 1. 2 FIC selects Curve 2. Default state.

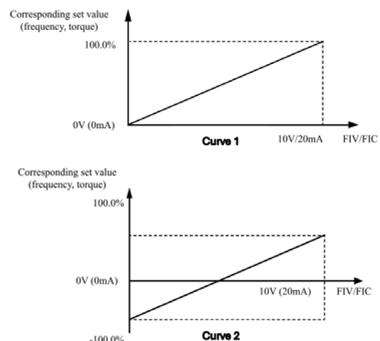


Figure 11

The selection of voltage and current for two analog input terminals can be set using the unit's digit and ten's digits of function code P4.40, as shown in the table below.

Table 30

Range	Description
P4.40	Unit's digit
	Ten's digit

Range	Description
P4.40	1 Analog input terminal is configured as FIV. Default state.
	2 Analog input terminal is configured as FIC.
Ten's digit	1 Analog input terminal is configured as FIV.
	2 Analog input terminal is configured as FIC. Default state.

7.5 P5 group: output terminal

The VSM is equipped with 1 collector output terminal DO, 1 multifunction relay output terminal RA-RB-RC, and 1 multifunctional analog output terminal FOV.

1. The functional code definitions for the collector output terminal DO and the multifunction relay output terminals RA-RB-RC are shown in the table. The DO terminal is a programmable multiplexed terminal that can serve as an open collector switching output terminal, effectively functioning as a second relay output.

Table 31

Range	Description
P5.00	1 Switching Outputs (DOR)
P5.01	1-40 DOR output function selection
P5.02	1-40 Relay Output Function Selection (RA-RB-RC)

The function of the DOR and the relay to output each set value is shown in the following table.

Table 32

Setpoint	Function	Description
0	No output	The output terminal has no function.
1	Running	When the VSM is operation, an ON signal is output.
2	Fault shutdown	If VSM fails and stops due to fault, an ON signal is output.
5	Running at zero speed (No output when stopped)	When VSM is running and the output frequency is 0, an ON signal is output. When the machine is in the shutdown state, the signal is OFF.

6	Motor overload pre-alarm	Before the VSM overload protection action, it is judged according to the threshold of the overload pre-alarm, and the ON signal is output after the pre-alarm threshold is exceeded.
7	Inverter overload pre-alarm	10 seconds before VSM overload protection occurs, an ON signal is output.
11	The PLC cycle is complete	When the simple PLC runs for a cycle, a pulse signal with a width of 250ms is output.
12	The cumulative run time has arrived	When the cumulative running time of the VSM exceeds the time set in P8.17, an ON signal is output.
13	Frequency limiting	When the set frequency exceeds the upper or lower frequency limits, and the VSM output frequency also reaches the upper or lower frequency limit, the ON signal is output.
14	Torque is being limited	In the speed control mode, when the output torque reaches the torque limit, the VSM is in the stall protection state and outputs an ON signal at the same time.
15	Ready to run	When the power supply of the VSM main circuit and the control circuit has been stabilized, and the VSM has not detected any fault information, the VSM is in a working state, and the ON signal is output.
16	FIV>FIC	When the value of the analog input FIV is greater than the input value of the FIC, the ON signal is output.
17	The upper limit frequency is reached	When the operating frequency reaches the upper limit frequency, the ON signal is output.
18	Lower Limit Frequency Reached (No Output in Shutdown)	When the operating frequency reaches the lower limit frequency, the ON signal is output. In the shutdown state, the signal is OFF.
19	Undervoltage state output	When the VSM is in the undervoltage state, an ON signal is output.
20	Communication settings	Please refer to the communication protocol.
23	Running at zero speed (Output even when stopped)	When the VSM output frequency is 0, an ON signal is output. In the shutdown state, the signal is ON.
24	The cumulative power-on time has arrived	When the cumulative power-up time (P7.13) of the VSM exceeds the time set by P8.16, an ON signal is output.
26	Frequency 1 reaches the output	Refer to the description of function codes P8.30 and P8.31.
28	Current 1 reaches the output	Refer to the description of function codes P8.38 and P8.39.
30	Timed arrival output	When the timing function selection (P8.42) is valid, the VSM outputs an ON signal after the time reaches the specified.
32	Loss of load	When the VSM loses load, an ON signal is output.
33	Running in reverse	When the VSM is running in reverse, it outputs an ON signal
35	The module temperature arrives	When the heatsink temperature of the drive module (P7.07) reaches the set module temperature value (P8.47), the ON signal is output.

2. The analog output FOV is output in the form of voltage 0-10V or current 0-20mA. Among them, FOV selects a specific function through the function code P5.07.

Table 33

Range	Description
P 5.07 0-15	FOV output function selection

The selection and configuration of the FOV analog output function are shown in the table below.

Table 34

Setpoint	Function	Description
0	Frequency of operation	0-Maximum output frequency
1	Set the frequency	0-Maximum output frequency
2	Output current	0-2 times the rated current of the motor
3	Output torque	0-2 times the rated torque of the motor
4	Output power	0-2 times the rated power
5	Output voltage	0-1.2 times the rated voltage of the inverter
7	FIV	0-10V
8	FIC	0-10V (or 0-20mA)
15	Communication settings	0.0%-100.0%

7.6 P6 group: start-stop control

1. Start-stop control

By default, the start-up DC braking time is set to 0. The VSM direct starts from the start-up frequency. If the starting DC braking time is not 0, the DC braking will be done first, and then the operation will start from the starting frequency. The direct start and start frequency function codes are set as follows.

Table 35

Range	Description
P6.00 0	Direct start
P6.03 0-10Hz	Start-up frequency
P6.04 0.0-100.0s	Start-up frequency hold time

To ensure the torque at start-up, set the appropriate starting frequency. For the magnetic flux to be fully established when the motor starts, the starting frequency needs to be maintained for a certain period.

The start-up frequency P6.03 is not limited by the lower frequency limit. However, if the target frequency is less than the startup frequency, the VSM does not start and is in standby mode.

During forward and reverse switching, the startup frequency hold time does not work. The start-up frequency hold time is not included in the acceleration time, but is included in the runtime of the simple PLC.

Example 1:

P0.04 = 0, the frequency source is digital given
P0.10 = 2.00Hz, the digital setting frequency is 2.00Hz

P6.03 = 5.00Hz, the start-up frequency is 5.00Hz
P6.04 = 2.0s, the start-up frequency holding time is 2.0s, the inverter will be in standby mode, and the inverter output frequency is 0.00Hz.

2. Slow down to stop

The VSM shutdown mode consists of two modes: deceleration stop and coasting stop, which is set by function code P6.10.

Table 36

Range	Description
P6.10 0	Deceleration stop
1	Coasting stop

Deceleration stop means that after a shutdown command, the VSM reduces the output frequency according to the deceleration time and stops after the frequency drops to 0.

Coasting stop means that after a shutdown command, the VSM immediately terminates the output, and the motor stops freely according to the mechanical inertia.

3. Frequency of starting process and stopping process

The frequency change of VSM start and stop process is set by function code P6.07.

Table 37

Range	Description
P6.07 0	Straight line acceleration and deceleration
1	S-curve acceleration and deceleration A

Linear acceleration and deceleration: The output frequency increases or decreases in a straight line. DM2 offers 4 types of acceleration and deceleration times. It can be selected by the digital input terminal (P4.00-P4.07).

S-curve acceleration and deceleration A: The output frequency increases or decreases according to the S-curve. S-curves are used in places that require a smooth start or stop, such as elevators, conveyor belts, etc. The function codes P6.08 and P6.09 define the time proportions of the start and end segments of the acceleration and deceleration of the S-curve, respectively.

Table 38

	Range	Description
P6.08	0.0% - (100.0%-P6.09)	The scale of the S-curve start time
P6.09	0.0% - (100.0%-P6.08)	The scale of the end time of the S-curve

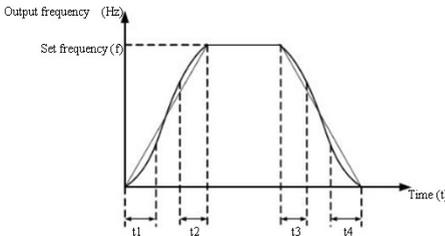


Figure 12 Schematic diagram of S-curve acceleration and deceleration A

7.7 P7 group: control panel and display

1. The STOP/RESET key of the VSM control panel can be set by the function code P7.02 to select different functions. The default value is 1, as follows.

Table 39

	Range	Description
P7.02	0	The stop function of STOP/RESET key is only valid when in control panel mode
	1	The stop function of STOP/RESET key is valid in any mode of operation. Default state.

2. The correspondence between VSM speed display and output frequency is modified by P7.06 parameter.

Table 40

	Range	Description
P7.06	0.0001-6.5000	Speed display factor

3. The temperature display of the IGBT of the VSM inverter module is viewed through P7.07, the cumulative running time is viewed through P7.09, the control board software version is displayed at P7.11, the cumulative power-on time is displayed at P7.13, and the cumulative power consumption is viewed by P7.14.

Table 41

	Range	Description
P7.07	0 - 120.0°C	Display the heatsink temperature of Inverter module
P7.09	0 - 65535 hours	Display the cumulative run time
P7.11	/	Display the control Board Software Version
P7.13	0 - 65535 hours	Display the cumulative power-on time
P7.14	0 - 65535 kW-hours	Display the cumulative power consumption

7.8 Other function codes

Descriptions of other function codes are shown in the following table. If users don't have a good understanding of function code and don't know how to set function codes, please contact ABB.

Table 42

Function Group	Description
P8 group	Auxiliary Functions for jogging running frequency, auxiliary acceleration/ deceleration time, jump frequency, forward/reverse rotation dead-zone time, cumulative power-on time output, start-up protection, frequency reaching detection, timing function.
P9 group	Fault and protection.
PA group	Process control PID function
PC group	Multi-speed commands and simple PLC Function.
PD group	Communication parameters.
PP group	Password function.
D0 group	Monitoring parameters.

7.9 Function codes protected by password

P1, P2, P8, P9, PA, PC, PD and PP are password-protected function code, which can only be displayed or modified after the correct password is entered. If you wish to modify relevant parameters (such as Simple PLC, Process PID, MODBUS RS-485, password parameters, and PWM control optimization...), please contact ABB.

8. Failure & Protection

The VSM has numerous warnings and protection functions. Once a fault occurs, the protection function mechanism is activated, the VSM halts operation, and the fault code is displayed on the drive display panel.

ABB may request additional information to determine whether certain models are suitable for use in special applications or require special design modifications.

8.1 Electrical Protection

8.1.1 Motor overload protection

The VSM overload protection function code is P9.00, and the default setting is 1. According to the inverse time curve of motor overload protection, the VSM will determine whether the motor is overloaded. The inverse time curve is as follows: If 195% of the motor's rated current is maintained for 1× (P9.01) minutes, an alarm for motor overload fault will be triggered. If 150% of the motor's rated current is maintained for 5× (P9.01) minutes, an alarm for motor overload will be triggered.

If the VSM is overloaded, the control panel displays the OL1 code.

Table 43

	Range	Description
P9.00	0	Motor overload protection is disabled
	1	Motor overload protection is enabled. Default setting.
P9.01	0.20-10.00	Motor overload protection gain

Note

If overload protection is not enabled, there may be a danger of overheating and damaging the motor. It is recommended that users keep the factory overload protection settings.

8.1.2 Power-on output, operation grounding fault protection

The function code P9.07 is set to 1 by default. The VSM detects whether the motor is short-circuited to the ground when it is powered. The VSM works normally if there is no short-circuit.

Table 44

	Range	Description
P9.07	0	Short-circuit protection to the ground is disabled
	1	Short-circuit protection to the ground is enabled. Default setting.

In the event of motor short-to-ground fault, the GND code is displayed on the control panel.

8.1.3 Input/output phase loss protection.

The function code for enabling input phase loss protection is P9.12, with a default setting of 1. The function code enabling output phase-loss protection is P9.13, also with a default setting of 1.

When input phase loss protection occurs, the LI code is displayed on the control panel. When output phase loss protection occurs, the LO code is displayed on the control panel.

Table 45

	Range	Description
P9.12	0	Input phase loss protection is prohibited
	1	Input phase loss protection is allowed. Default setting.
P9.13	0	Output phase loss protection is prohibited
	1	Output phase loss protection is allowed. Default setting.

8.1.4 Motor overheating protection

Motor overtemperature protection is only effective if the PT100 is installed inside the motor, and this function is optional for the customer. If the user needs to send the PT100 thermistor signal to the higher-level control system, the PT100 terminal cable can be connected to the corresponding port of the higher-level control system. The PT100 thermistor has a maximum measured voltage of 2.5V and a maximum measured current of 5mA. Using higher measurement voltages or currents can result in incorrect readings or damage to the system. When connecting PT100 to a control system, make sure to provide adequate insulation or isolation, see IEC60664.

Table 46

	Range	Description
P9.56	0	Disable the PT100 function. Default setting.
	1	Turn on the PT100 function
P9.57	0 - 200°C	Motor alarm temperature setting. Default setting is 120°C.

8.1.5 Drive overheating protection

If the inverter module heatsink temperature exceeds the factory setting, then the control panel will display the OH code.

8.1.6 Over-voltage/under-voltage protection

The function code of the under-voltage protection setting is L5.06, and the default setting is 350V. When undervoltage protection occurs, the LU code is displayed on the operation panel.

The function code of the overvoltage protection setting is L5.09, and the default setting is 820V. When overvoltage protection occurs during acceleration, the OU1 code is displayed on the control panel. In the same way, the OU2 code is used in the deceleration process, and the OU3 code is used in the constant speed process.

Table 47

	Range	Description
L5.06	350 - 820V	Set the drive undervoltage fault. Default setting is 350V (DC bus voltage).
L5.09	350 - 820V	Set the drive overvoltage fault. Default setting is 820V (DC bus voltage).

8.2 Flying Start

The VSM has the flying capability to start while the shaft has initial speed. However, this flying capability only supports an initial speed below one-third of the rated speed. When the initial speed exceeds one-third of the rated speed, overvoltage protection will occur.

8.3 EMC

To provide proper grounding and to ensure compliance with current EMC requirements, symmetrical shielded cables (VFD cables) are highly recommended for motors with a power of less than 30 kW. Implement 360 ° grounding connections at all cable entry points. Twist the cable shield into bundles and connect to the nearest ground terminal/busbar of the VSM.

The VSM has been tested in accordance with the EN IEC 61800-3:2023 standard (Adjustable Speed Electrical Power Drive Systems - Part 3: EMC Requirements and Specific Test Methods for PDS and Machine Tools), and all test items meet the standard requirements and have passed the tests.

Generally, the amplitude in the basic high-frequency (150kHz to 30MHz) emission test meets the Category C3 limit requirements. If compliance with Category C2 limit requirements is necessary, an external filter can be connected. The harmonic or interharmonic content in basic low-frequency (<150kHz) emissions complies with Category C3 requirements. If compliance with Category C2 requirements is needed, an external reactor can be connected.

The recommended external filter and external reactor model are given in the table below.

Table 48

Frame	Filter	Reactor
71	EN360-20S	ACR-0010-2M40-0.78C
80	EN360-20S	ACR-0010-2M40-0.78C
90	RF14C20N6P	ACR-0020-1M40-0.45C

Note

According to IEC/EN 61800-3, under the C3 category, the power supply for the VSM is not connected to the low-voltage public distribution network. When the VSM's power supply is connected to the low-voltage public distribution network, an external reactor is required to meet the Total Harmonic Distortion of Current (THDI) requirements specified in the IEC 61000-3-2/12 standard.

8.4 Working speed

When the speed is higher than the nominal speed given on the nameplate or in the relevant product catalog, the control panel displays the oSP code.

It is important to ensure that the working speed does not exceed the maximum allowable speed of the motor or the critical speed of the entire application.

WARNING

Do not exceed the maximum allowable speed of the machine. Please refer to the relevant product brochure and nameplate information.

8.5 Fault reset

After the VSM fails, the control panel will display the relevant fault information. The user can reset the fault through the STOP key on the keyboard or the terminal function (P4 group). The VSM will be in standby mode after the fault resets. If the VSM is in a fault state and the user does not reset the fault, the VSM will remain in the operation protection state and cannot operate.

9. Maintenance**9.1 General inspection**

1. Inspect the VSM at regular intervals, at least once a year. The frequency of checks depends on, for example, installation environment and the humidity level. The inspection frequency can initially be determined experimentally and must then be strictly followed.
2. Keep the VSM clean and ensure free ventilation airflow. If the VSM is used in a dusty environment, the ventilation system must be regularly checked and cleaned.
3. Check the condition of shaft seals (e.g. V-ring or radial seal) and replace if necessary.
4. Check the condition of connections and mounting and assembly bolts.
5. Check the bearing condition by listening for any unusual noise, vibration measurement, bearing temperature, inspection of spent grease, or SPM bearing monitoring. Pay special attention to bearings when their calculated rated lifetime is coming to an end.

When signs of wear are noticed, dismantle the motor, check the parts and replace those if necessary. When bearings are changed, replacement bearings must be of the same type as those originally fitted. The shaft seals must be replaced with seals of the same quality and characteristics as the originals when changing bearings.

In the case of the IP55 motor and when the motor has been delivered with a closed plug, it is advisable to periodically open the drain plugs to ensure the way out for condensation is not blocked and allows condensation to escape from the motor. This operation must be done only when the motor is completely off at a standstill and has been secured to ensure it is safe to work on.

9.2 Lubrication

WARNING

Beware of all rotating parts!

Bearing lubrication intervals is vital issue for motor reliability.

9.2.1 Machines with permanently greased bearings

Bearings are usually permanently greased and come in types 1Z, 2Z, 2RS or equivalent.

Duty hours for permanently greased bearings at ambient temperatures of 25° C and 40° C are given in the table below.

Lubrication intervals according to L₁₀ principle.

Table 49

Frame	Speed/rpm	Duty hours at 25° C	Duty hours at 40° C
71	4500	40000	38000
71	3000	40000	40000
71	1500	40000	40000
80	4500	38000	30000
80	3000	40000	32000
80	1500	40000	40000
90	4500	36000	25000
90	3000	40000	27000
90	1500	40000	40000

These values are valid for permitted load values given in the product catalog. Depending on application and load conditions, see the applicable product catalog or contact ABB.

Operation hours for vertical motors are half of the above-mentioned values.

WARNING

The maximum operating temperature of the grease and bearings, +110 ° C, must not be exceeded. The designed maximum speed of the motor must not be exceeded.

10. After Sales Support

10.1 Spare parts

When ordering spare parts, the motor serial number, full type designation and product code, as stated on the rating plate, must be specified. For more information, please visit our website www.abb.com.

10.2 Rewinding

Rewinding should always be carried out by qualified repair shops.

Smoke extraction and other special motors should not be rewound without first contacting ABB.

10.3 Bearings

Special care should be taken with the bearing replacements. These must be removed using pullers and fitted by heating or using special tools for the purpose.

Bearing replacement is described in detail in a separate instruction leaflet available from the ABB Sales Office.

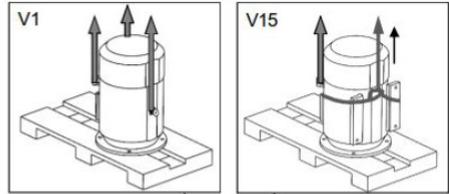
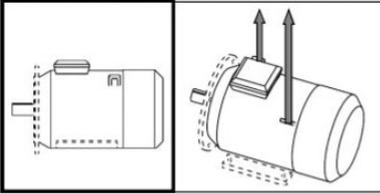
Additional manual for Hoisting Instructions

WARNING

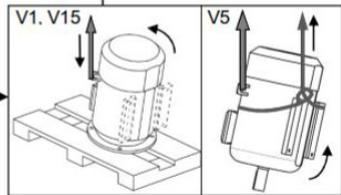
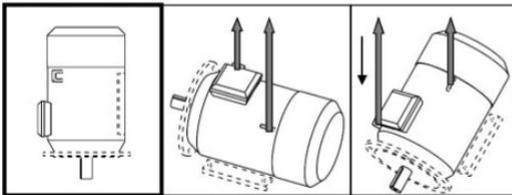
Improper handling and lifting of motor may cause death, serious injury or property damage. Only qualified personnel shall be used for lifting and installing the motor.

Before lifting: Check lifting devices and note weight! The actual weight is stated on the rating plate of the motor.

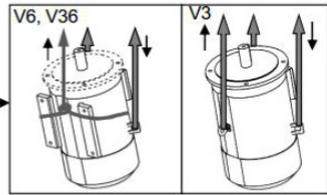
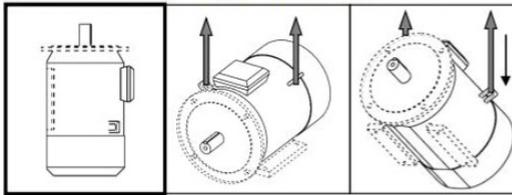
IM B3/ IM 1001, IM B5/IM3001, IM B35/IM2001



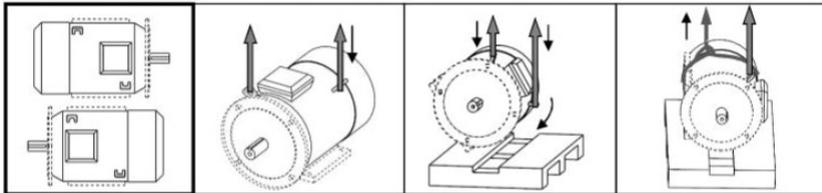
IM V5/ IM 1011, IM V1/IM3011, IM V15/IM2011



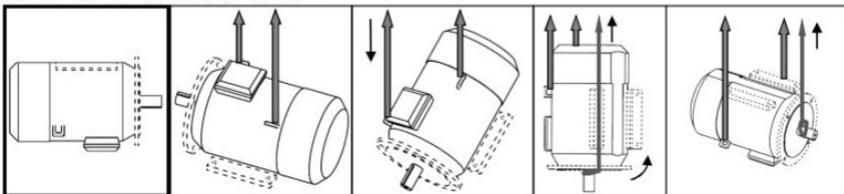
IM V6/ IM 1031, IM V3/IM3031, IM V36/IM2031



IM B6/ IM 1051, IM B7/1061, IM 3051, IM3061, IM2051, IM2061



IM B8/ IM 1071, IM3071, IM2071



Appendix A

Information for users, waste treatment facilities and marking

This document is prepared according to EU Directive 2012/19/EU (WEEE) to give endusers the necessary information on how to 'treat and dispose of EEE (Electrical and Electronic Equipment) waste after it has been removed from service and is to be recycled.

Marking of the products

Products that are marked with the crossed-out wheeled bin symbol as below and/or the symbol is included in its documentation shall be handled in the following way:



For private households

The crossed-out wheeled bin symbol on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste. For proper treatment, recovery and recycling, please take this product(s) to designated collection points where it will be accepted free of charge.

Alternatively, in some countries, you may be able to return your products to your local retailer upon purchase of an equivalent new product.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which might otherwise arise from inappropriate waste handling.

Please contact your local authority for further details of your nearest designated collection point. Depending on your national legislation, incorrect disposal of this waste may incur a penalty in your country.

For professional users in the European Union

The crossed-out wheeled bin symbol on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste, If you wish to dispose of electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

For disposal in countries outside the European Union

The crossed-out wheeled bin symbol is only valid in the European Union (EU) and means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste. If you wish to dispose of this product, please contact your local authorities or dealer for the correct method of disposal.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.



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