



Read carefully the safety instructions in this manual before operating. Failure to follow them can result in death, severe personal injury or considerable damage to the equipment. Without prior authorization, you are not allowed to perform any modification on the drive.

### 1. General

#### Warning labels on servo drives

**Risk of electrical shock.** Do not touch any terminals or disassemble cables until the drive has been disconnected from power for at least **5 minutes**.

**Hot surface.** Do not touch the heat sink of the drive during operation or within a certain period since power disconnection because its surface temperature is higher than **65 °C**.

**Caution.** Pay attention to the information given on the rating plate and operating instructions. For more information, refer to *SINAMICS V70/SIMOTICS 1FL6 Operating Instructions*.



#### WARNING

##### Death or severe personal injury from violations of five safety rules

When carrying out any kind of work on electrical devices, the "five safety rules" according to EN 50110 must always be observed:

1. Disconnect the system.
2. Protect against reconnection.
3. Make sure that the equipment is de-energized.
4. Ground and short-circuit.
5. Cover or enclose adjacent components that are still live.

Failure to observe the above five rules can result in death, severe personal injury or considerable damage to property.



#### WARNING

##### Death or severe personal injury from maloperations

Maloperations may cause death, severe personal injury, or considerable damage to property. Only **qualified personnel** should be allowed to work on the drive system and only after becoming acquainted with all the safety notices regarding installing, connecting, commissioning, operation and maintenance as set out in this manual. In addition, both the motor and the drive are **maintenance-free**, and thus it is forbidden to open them or repair them.

### 2. Transport and storage

#### NOTICE

##### Property loss

Notify Siemens service personnel immediately of any damage discovered after delivery. If the equipment is put into storage, keep it in a dry, dust-free, and low-vibration environment. The storage temperature ranges from  $-40^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ . Otherwise you will suffer property loss.

### 3. Mechanical installations



#### WARNING

##### Death or severe personal injury from harsh installation environment

A harsh installation environment will jeopardize personal safety and equipment. Therefore,

- Do not install the drive and the motor in an area subject to inflammables or combustibles, water or corrosion hazards.
- Do not install the drive and the motor in an area where it is likely to be exposed to constant vibrations or physical shocks.
- Do not keep the drive exposed to strong electro-magnetic interference.
- Make sure that no foreign body (e.g., chips of wood or metal, dust, paper, etc.) can be seen inside the drive or on the heat sink of the drive.
- Make sure that the drive is installed in an electrical cabinet with an adequate protection class.

#### NOTE

##### Mounting clearance

To guarantee good heat dissipation and ease of cabling, keep sufficient clearance between drives, one drive and another device/inner wall of the cabinet. For details, refer to *SINAMICS V70/SIMOTICS 1FL6 Operating Instructions*.

#### NOTE

##### Screw tightening for mechanical installation

Siemens recommends that you tighten the screw on the terminal door of the drive, after you have completed the installation work.



##### Screw type

M3 (for terminal doors)  
M5 (for back plate)

##### Recommended tightening torque

0.5 Nm  
2.0 Nm

### 4. Electrical installation



#### WARNING

##### Personal injury and damage to property from improper connections

Improper connections have high risks of electrical shock and short circuit, which will jeopardize personal safety and equipment.

- The drive must be directly connected with the motor. It is not permissible to connect a capacitor, inductor or filter between them.
- Make sure that all connections are correct and reliable, the drive and the motor are well grounded.
- The line supply voltage must be within the allowable range (refer to the drive rating plate). Never connect the line supply cable to the motor terminals U, V, W or connect the motor power cable to the line input terminals L1, L2, L3.
- Never wire up the U, V, W terminals in an interchanged phase sequence.
- If the CE marking for cables is mandatory in some cases, the motor power cable, line supply cable and brake cable used must all be shielded cables.
- For terminal box connection, make sure that the clearances in air between non-insulated live parts are **at least 5.5 mm**.
- Route signal cables and power cables separately in different cable conduits. The signal cables shall be **at least 10 cm** away from the power cables.
- Cables connected may not come into contact with rotating mechanical parts.



#### CAUTION

##### Personal injury and damage to property from inadequate protection

Inadequate protection may cause minor personal injury or damage to property.

- The drive must have been disconnected from the power supply for at least **5 minutes** before you perform any wiring to it.
- **Check that the equipment is dead!**
- Make sure that the drive and the motor are properly grounded.
- All the external DC supply voltage used with the equipment must be derived from safety extra low voltage (SELV) supply based on EN 61800-5-1.
- The communication port and the control terminals are double insulated and meet the requirements for SELV (Safety Extra Low Voltage) in EN 61800-5-1, and it shall be connected to other circuits classified as SELV.
- Route a second PE conductor with the cross-section of the supply system lead in parallel to the protective earth via separate terminals or use a copper protective earth conductor with a cross-section of  $10\text{ mm}^2$ .
- Terminals for equipotential bondings that exist in addition to terminals for PE conductors must not be used for looping-through the PE conductors.
- To ensure protective separation, an isolating transformer must be used for the 380 V AC line supply system.

#### NOTICE

##### Damage to property from incorrect input voltage

Incorrect input voltage will cause severe damage to the drive. It is recommended that the actual input voltage should not be greater than 110% of the rated voltage or smaller than 75%.

#### NOTE

##### Cable cross-sections and screw tightening torque

	Connector type	Max. cross-section
	Barrier terminals	$2.5\text{ mm}^2$
	Pluggable terminals	$1.5\text{ mm}^2$
	Screw type	Tightening torque
	M4 (for barrier terminals)	2.25 Nm
	M2.5 (for pluggable terminals)	0.4 to 0.5 Nm

#### NOTE

##### STO wiring

The Safe Torque Off (STO) function can stop a motor using safety relays without involving any upper level control. It is disabled in the factory configuration by short-circuiting the STO terminals. The safety function of the servo drive is SIL 2 (EN61800-5-2). Connect the STO terminals as the actual requirements.

## 5. Commissioning/Operation



### WARNING

#### Touching rotating shaft may cause personal injury.

When the motor is rotating at a high speed, touching the shaft may cause severe personal injury.  
Do not touch the motor shaft when the motor is running.



### WARNING

#### Risk of electrical shock when without protective grounding

If the drive operates without grounding, the electrical shock may cause personal injuries. Before operation, an external PE conductor or a protective bonding that implements safety class I must be connected.



### CAUTION

#### Burns from hot surface

The operating temperature of drive base-plate and heat sink is **higher than 65°C**, and the surface temperature of the motor may reach up to **80°C**.  
The hot surface may burn your hands.

Do not touch the motor or the heat sink of the drive during operation or within a certain period since power disconnection.

### NOTICE

#### Damage to equipment from high operation temperature

High ambient temperature may cause damage to the drive.  
Ensure that the temperature of the air at the inlet port of the heat sink does not exceed 45 °C, and the exhaust air is not recycled into the inlet port of the heat sink or into the drive.

### NOTICE

#### Shortening the service life of motor brake

The motor brake is used for holding purpose only.  
Frequent emergency stops with the motor brake will shorten its service life.  
Unless absolutely necessary, do not apply the motor brake as an emergency stop or deceleration mechanism.

### NOTICE

#### Damage to the equipment from frequent power-on/off

Frequent power-on/off will cause damage to the drive.  
Do not switch on/off the power frequently.

### NOTE

#### Voltage requirement

Before switching the power on, make sure that the drive system has been reliably installed and connected, and the line supply voltage is within the allowable range.

### NOTE

#### Drive disfunctioning due to power derating

Some environmental factors may result in power derating, e.g. latitude and ambient temperature. In this case, the drive cannot work normally.  
Environmental factors must be taken into account during commissioning or operation.

### NOTE

#### Drive functioning interfered by use of radio devices

Mobile radio devices can interfere with the normal functioning of the drive.  
Do not use mobile radio devices (e.g. cell phone, walky-talkies) with a transmission power > 1 W in the immediate vicinity of the devices (< 1.8 m).

### NOTE

#### Commissioning sequence

Only after you have successfully carried out the commissioning with the motor operating under dry-run conditions, can you perform commissioning with the motor operating under loaded conditions.

## 6. Troubleshooting



### WARNING

#### Risk of electric shock

The drive remains charged in a short period after it is powered off.  
Touching terminals or disassembling cables may cause minor injury due to electrical shock.  
Do not touch terminals or disassemble cables until the drive system has been disconnected for at least **5 minutes**.



### WARNING

#### Personal injury due to unexpected restart

The machine might unexpectedly restart after the power supply that was suddenly switched off is switched on again. Touching the machine at this time may cause personal injury.  
Do not approach the machine after the power supply is switched on again.

### NOTE

#### Voltage test

All SINAMICS V70 connections must be withdrawn or disconnected when the electrical equipment on the machines is subject to a voltage test [EN60201-1 (VDE 0112-1), Point 20.4] for an electrical device on the machine tool. This is unnecessary, as the SINAMICS V70 insulation has already been tested, and should not be subject to a new test (additional voltage stressing).

## 7. Disposal

### NOTE

#### Equipment disposal

Disposal of the equipment must be made in accordance with the regulations of the competent environmental protection administration on the disposal of electronic wastes.

## 8. ESD instructions



### NOTICE

#### Damage to property from violations of ESD instructions

An electrostatic-sensitive device (ESD) is an individual component, integrated circuit, or module that can be damaged by electrostatic fields or discharges. Violations of the following ESD regulations may cause damage to property.

ESD regulations for handling boards and equipment:

- When handling components that can be destroyed by electrostatic discharge, it must be ensured that personnel, the workstation and packaging are well grounded!
- Personnel in ESD zones with conductive floors may only touch electronic components if they are grounded through an ESD bracelet and wearing ESD shoes or ESD shoe grounding strips.
- Electronic boards may only be touched when absolutely necessary. Electronic boards may not be brought into contact with plastics and articles of clothing manufactured from man-made fibers.
- Electronic boards may only be placed on conductive surfaces (table with ESD surface, conductive ESD foam rubber, ESD packing bag, ESD transport containers).
- Electronic boards may not be brought close to data terminals, monitors or television sets.
- Measurements may only be carried-out on electronic boards and modules if the measuring instrument is grounded (e.g. via a protective conductor) or before making measurements with a potential-free measuring device, the measuring head is briefly discharged (e.g. by touching an unpainted blank piece of metal on the control cabinet).

## 9. Certification

### NOTE

#### EMC instructions

- All products of SINAMICS V70 meet the EMC standards of CE, with the use of shielded motors, and line input cables (shielded between a line filter and the drive).
- For a radiated emission test, the drive will be installed inside the shielded chamber, other parts of the motion control system (including the NC system, PLC, DC power supply, spindle drive, motor) will be put outside the shielded chamber.
- For a conductive emission test, an external AC filter (between the 380 V AC power supply and the drive) will be used to meet the EMC requirement.
- The operational environment of drives is the industrial area, and therefore the limit class C3 is applicable to SINAMICS V70 according to EN61800-3.

## 10. Technical support

Country	Hotline
China	+86 400 810 4288
Germany	+49 (0) 911 895 7222
Italy	+39 (02) 24362000
India	+91 22 2760 0150
Turkey	+90 (216) 4440747
For further service contact information, visit: <a href="http://support.automation.siemens.com/WW/view/en/16604999">http://support.automation.siemens.com/WW/view/en/16604999</a> .	

Keep this document as a handy reminder.

(2013 年 8 月)



在操作本设备之前，请务必认真阅读本手册中的安全说明。如果不遵守该安全说明，则可能会造成人员死亡、严重人身伤害或者对设备造成重大损坏。未经授权，不得对本设备进行任何改造。

### 1. 一般注意事项

#### 伺服驱动上的警示标签



**触电危险。** 在设备断电后的 **5 分钟** 内，严禁触摸接线端子或插拔电缆。



**高温危险。** 在设备运行时或断电后的短时间内，严禁触摸散热器，其表面温度高于 **65 °C**。



**注意。** 请关注设备铭牌和操作说明手册所提供的信息。更多信息，请参见《SINAMICS V70/SIMOTICS S-1FL6 操作说明》。



**警告**

#### 违反五项安全规定可能导致人员死亡、人身伤害或者设备损坏

在所有电气设备上开展作业时，必须按照指定的顺序执行以下五项安全规定（EN50100）。

1. 断开电源
2. 确保不会重新接通电源
3. 确认设备无电压
4. 接地并短接
5. 遮盖或屏蔽邻近的带电部件。

如果不遵守以上安全规定，则可能会造成人员死亡、严重的人身伤害或者对设备造成重大损坏。



**警告**

#### 操作不当可能导致人员死亡、人身伤害或者设备损坏

误操作可能造成人员死亡、严重的人身伤害或者对设备造成重大损坏。

仅**合格的专业人员**在了解本手册中所有关于安装、连接、调试、操作以及维护等安全说明后才能操作此驱动系统。

另外，电机和驱动都为**免维修设备**，请勿擅自拆装或维修。

### 2. 运输和存放

#### 注意

##### 设备损失

在验收设备时发现的任何损坏，请立即通知西门子服务人员。

存放设备时，请保证环境的干燥、无尘和低振动。

储存环境温度应为 **-40 °C** 到 **+70 °C**。

否则会造成您的设备财产损失。

### 3. 机械安装



**警告**

#### 不当的安装环境导致人员死亡、人身伤害或者设备损坏

在设备运行时，不当的环境会威胁到您的人身安全和设备安全。因此，

- 切忌将本驱动和电机安装在易燃、易爆、多水或者含有腐蚀性物质的环境中。
- 切忌将本驱动和电机安装在不断有振动或者物理震动的区域中。
- 切忌将本驱动安装在强电磁辐射的环境中。
- 确保驱动内部或其散热器上无任何杂质（如：木屑、铁屑、灰尘、纸片等）。
- 确保将驱动安装在具有适当保护等级的电柜中。

#### 说明

##### 安装间距

为了保证良好的散热效果和接线方便，请确保驱动之间以及驱动与另一个设备/电柜内壁之间存在足够的间距。

更多信息，请参见《SINAMICS V70/SIMOTICS S-1FL6 操作说明》。

#### 说明

##### 安装时拧紧螺丝

在完成安装和接线后，建议关上端子门并拧紧螺丝，以确保安全。



螺丝类型	建议扭矩
M3（用于端子门）	0.5 Nm
M5（用于背板）	2.0 Nm

### 4. 电气安装



**警告**

#### 接线不当可能导致人身伤害或者设备损坏

接线不当存在很大的电击和短路风险，从而威胁到您的人身安全和设备安全。

- 驱动与电机必须直接连接。在它们之间不可连接电容器、感应器或者滤波器。
- 主电源电压必须处在允许的电压范围（参见驱动铭牌）之内。
- 切忌将电源输入电缆与 U、V、W 等电机端子连接，切忌将电动机动力电缆 L1、L2、L3 主电源输入端子连接。
- 切忌不按相位顺序进行接线。
- 如果系统必须要有 CE 标记，则使用的动力电缆、电源输入电缆和抱闸电缆都必须是屏蔽电缆。
- 对于接线盒连接，确保非绝缘的带电部件之间的隔空距离大于 **5.5 mm**。
- 信号电缆和电力电缆需排在不同的电缆通道中，它们之间至少要有 **10 cm** 的间距。
- 已连接的电缆不可与旋转的机械部件接触。



**小心**

#### 保护措施不足导致人身伤害或者设备损坏

保护措施不足会威胁到您的人身安全和设备安全。

- 必须在驱动断电**至少 5 分钟**后才能对其进行接线操作。
- **必须检查确认设备不带电！**
- 确保对驱动和电机都进行了正确接地。
- 设备使用的所有外部直流电压必须来自于安全低压电源（SELV，参见 EN61800-5-1）。
- 通讯端口和控制电路端子为双重绝缘，满足 SELV 要求，并且连接的其他电路也为安全电压。
- 使用的第二根保护接地线线径应与电源线保持一致，且二者通过不同的端子分别接地，或者使用线径为 **10 mm<sup>2</sup>** 的铜质地线来共用一个端子接地。
- 保护接地端子中的等势端子不可形成环路。
- 为了确保保护距离，三相 **380 V** 交流电源系统则必须始终使用隔离变压器。

#### 注意

##### 输入电压错误导致设备损坏

错误的输入电压可能会对驱动设备造成严重的损坏。

建议实际输入电压不高于额定电压的 **110%** 或低于额定电压的 **75%**。

#### 说明

##### 线径和螺钉紧固扭矩

	连接器类型	最大线径
	栅栏式端子	2.5 mm <sup>2</sup>
	可插拔端子	1.5 mm <sup>2</sup>
	螺丝类型	建议扭矩
	M4（用于栅栏式端子）	2.25 Nm
	M2.5（用于可插拔端子）	0.4 到 0.5 Nm

#### 说明

##### STO 连线

安全扭矩停止（STO）功能可以通过保安继电器而不通过上位控制器来停止电机。STO 端子在出厂设置时是端接的，默认不启用该功能。本设备的安全等级 SIL 2（EN61800-5-2）。

请根据实际情况选择是否连接 STO 端子。

### 5. 运行与调试



**警告**

#### 触摸旋转轴可能导致人身伤害

电机高速运行时请勿触摸电机轴，否则会造成人身伤害。



**警告**

#### 无接地保护运行时存在电击风险

在没有接地保护的情况下运行时，存在电击风险，可能会导致人身伤害。运行前必须确保设备连接了 **I 级安全等级** 的保护地线或屏蔽保护地线。



**小心**

#### 表面高温

设备运行时，驱动的底座和散热器表面温度高于 **65 °C**，电机的表面温度最高达 **80 °C**。触摸高温表面可能导致严重烫伤。

在设备运行时或断电后的短时间内，切忌触摸电机或者驱动的底座和散热器。

**注意**  
**高运行温度导致设备损坏**  
 环境温度过高可能导致驱动系统损坏。  
 必须确保散热器进风口的温度低于 **45 °C**，并且排出的热气流不会再通过进风口循环进入散热器或者驱动内。

**注意**  
**无接地保护运行时设备存在损坏风险**  
 在没有接地保护的情况下运行时，驱动系统存在电击风险。  
 运行前必须确保设备连接了 **I 级安全等级** 的保护地线或屏蔽保护地线。

**注意**  
**缩短电机制动器使用寿命**  
 电机制动器主要用于抱闸，仅限偶尔的急停操作。频繁使用制动器进行急停操作会缩短其使用寿命。因此除非必要，请勿将电机制动器用作急停或减速目的。

**注意**  
**频繁上下电导致设备损坏**  
 频繁上下电会造成驱动设备损坏。  
 请勿频繁对设备进行上下电。

**说明**  
**电压要求**  
 在接通电源之前，必须确保驱动系统安装和连接正确，并且主电源电压处在允许电压范围之内。

**说明**  
**电源降额导致驱动不能正常工作**  
 一些环境因素（如：海拔高度、环境温度）会导致电源降额。此时，驱动系统不能正常工作。  
 因此在运行或调试时，必须充分考虑环境因素。

**说明**  
**移动无线设备干扰驱动的运行**  
 移动无线设备（如：手机、对讲机）可能会干扰驱动的正常运行。  
 在直径 **1.8 m** 的范围内，请勿使用发射功率大于 **1 W** 的移动无线设备。

**说明**  
**调试顺序**  
 只有先在不负载的情况下通过电机调试，才可在带负载的情况下进行电机调试。

## 6. 故障处理

 **小心**  
**触电危险**  
 在设备断电后的 **5 分钟** 内，设备可能依然带电。  
 触摸接线端子或拆拔电缆存在触电危险。  
 因此请在设备断电 **5 分钟** 后再进行相关维护操作。

 **警告**  
**设备意外上下电导致人身伤害**  
 突然断电后的设备可能会重新自动上电。此时触摸设备可能导致人身伤害。  
 因此在设备突然重新上电后，请勿靠近设备。

**说明**  
**电压测试**  
 当设备上的电气设备需要进行电压测试 [EN60201-1 (VDE 0112-1), 第 20.4 点] 时，必须断开 SINAMICS V70 上的所有连接。由于 SINAMICS V70 已经通过绝缘测试，因此无需再做一次测试（额外的电压应力）。

## 7. 报废处理

**说明**  
**报废处理**  
 设备的报废处理必须遵循环保部门关于电子废品处理的相关法规。

## 8. ESD 规定

 **注意**  
**违反 ESD 规定导致设备损坏**  
 有静电危险的部件（ESD）是一些单个部件、集成电路或者组件，它们都可能由于静电场或者静电放电而受到损坏。违反 ESD 规定可能导致设备损坏。ESD 处理规定：  
 • 处理电气元件时，必须注意对人、工作场地和包装来说良好的接地！  
 • 只有当相关人员穿戴 ESD 手腕带和 ESD 鞋（或者 ESD 鞋接地带）时才允许在带有导电地面的 ESD 区域中接触电气元件。  
 • 只有在无法避免的情况下才能接触电气组件。  
 • 电气组件不得接触塑料或者带有塑料部件的饰件。  
 • 电气组件仅允许放置在导电垫上（带有 ESD 支架的台子、导电的 ESD 泡沫塑料、ESD 包装袋、ESD 运输支架）。  
 • 电气组件不得放置在可视显示器、监视器或者电视机附近。离屏幕距离大于 **10 cm**。  
 • 只有当测量装置已接地（例如通过保护性接地）或者测量前对于电位为零的测量头短时放电（例如接触有金属裸露在外的控制装置外壳）时，才允许对电气元件进行测量。

## 9. 认证

**说明**  
**EMC 说明**  
 • 通过使用屏蔽电机动力电缆和主电源电缆（滤波器到驱动段），SINAMICS V70 的所有模块都满足 CE 中规定的 EMC 标准。  
 • 对于辐射测试，驱动系统安装在屏蔽箱内，其他运动控制系统（包括数控系统、直流电源、主轴驱动、电机）安装在屏蔽箱之外。  
 • 对于传导发射测试，将在 **380 V** 交流电源与驱动系统之间安装外部交流滤波器，以满足 EMC 要求。  
 • 驱动系统的运行环境为工业环境，因此限制类别 **C3** (EN61800-3) 适用于 SINAMICS V70。

## 10. 技术支持

国家	热线
中国	+86 400 810 4288
德国	+49 (0) 911 895 7222
意大利	+39 (02) 24362000
印度	+91 22 2760 0150
土耳其	+90 (216) 4440747

更多服务联络信息，请访问：  
<http://support.automation.siemens.com/CN/view/zh/16604999>

请将本手册放在方便查阅的地方。