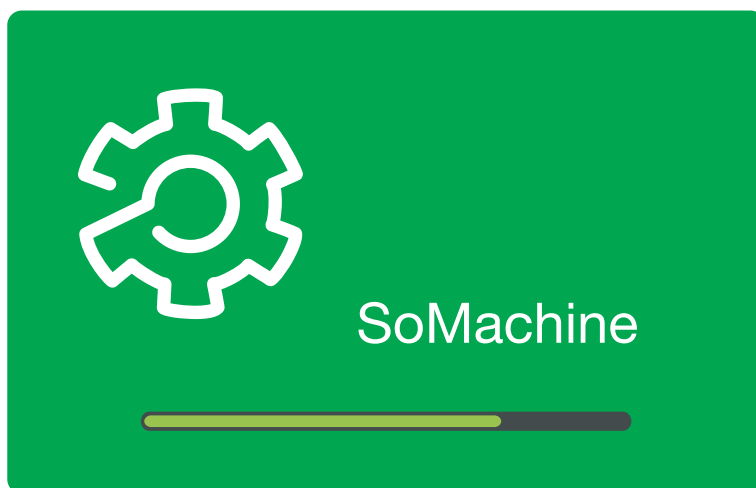


# CANmotion Library

Function blocks

Software manual

V2.09, 03.2012



## Important information

This manual is part of the product.

Carefully read this manual and observe all instructions.

Keep this manual for future reference.

Hand this manual and all other pertinent product documentation over to all users of the product.

Carefully read and observe all safety instructions and the chapter "Before you begin - safety information".

Some products are not available in all countries.  
For information on the availability of products, please consult the catalog.

Subject to technical modifications without notice.

All details provided are technical data which do not constitute warranted qualities.

Most of the product designations are registered trademarks of their respective owners, even if this is not explicitly indicated.

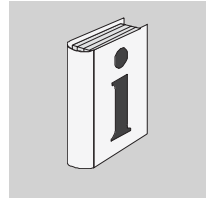
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## About this manual



This manual is an extract of the SoMachine Online Help. Fully read and understand all manuals of the SoMachine Online Help and of the products used.

### *Purpose of this document*

This document describes the functions of the CANmotion Lexium Library.

Software environment	Devices	Fieldbus
SoMachine Device Descriptions of version 3.2 and higher are supported.	LXM05 SD328 LXM32	CANmotion

### *Validity note*

This document is valid for SoMachine as of Version 2.0.

### *Source manuals*

The latest versions of the manuals can be downloaded from the Internet at:

<http://www.schneider-electric.com>

### *Corrections and suggestions*

We always try to further optimize our manuals. We welcome your suggestions and corrections.

Please get in touch with us by e-mail:

[techcomm@schneider-electric.com](mailto:techcomm@schneider-electric.com).

### *Work steps*

If work steps must be performed consecutively, this sequence of steps is represented as follows:

- Special prerequisites for the following work steps
- ▶ Step 1
- ◁ Specific response to this work step
- ▶ Step 2

If a response to a work step is indicated, this allows you to verify that the work step has been performed correctly.

Unless otherwise stated, the individual steps must be performed in the specified sequence.

### *SI units*

SI units are the original values. Converted units are shown in brackets behind the original value; they may be rounded.

Example:

Minimum conductor cross section: 1.5 mm<sup>2</sup> (AWG 14)

### *Glossary*

Explanations of special technical terms and abbreviations.

### *Index*

List of keywords with references to the corresponding page numbers.

*Disclaimer* The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products described here. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any user or integrator to perform the appropriate and fully comprehensive risk analyses, evaluation and testing of the products with respect to the relevant specific application or use of the products. Neither Schneider Electric nor any of its affiliate or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of Schneider Electric.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

# 1 Before you begin - safety information

# 1

## 1.1 Qualification of personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. In addition, these persons must have received safety training to recognize and avoid hazards involved. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by changing the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used.

All persons working on and with the product must be fully familiar with all applicable standards, directives, and accident prevention regulations when performing such work.

## 1.2 Intended use

This product is a library for industrial use with the appropriate controllers and drives.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements and the technical data.

Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented.

Since the product is used as a component in an entire system, you must ensure the safety of persons by means of the design of this entire system (for example, machine design).

Any use other than the use explicitly permitted is prohibited and can result in hazards.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.

### 1.3 Hazard categories

Safety instructions to the user are highlighted by safety alert symbols in the manual. In addition, labels with symbols and/or instructions are attached to the product that alert you to potential hazards.

Depending on the seriousness of the hazard, the safety instructions are divided into 4 hazard categories.

#### **DANGER**

DANGER indicates an imminently hazardous situation, which, if not avoided, **will result** in death or serious injury.

#### **WARNING**

WARNING indicates a potentially hazardous situation, which, if not avoided, **can result** in death, serious injury, or equipment damage.

#### **CAUTION**

CAUTION indicates a potentially hazardous situation, which, if not avoided, **can result** in injury or equipment damage.

#### **CAUTION**

CAUTION used without the safety alert symbol, is used to address practices not related to personal injury (e.g. **can result** in equipment damage).



## 1.4 Basic information

**⚠ WARNING****LOSS OF CONTROL**

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop, overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical functions.
- System control paths may include communication links. Consideration must be given to the implication of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.<sup>1)</sup>
- Each implementation of the product must be individually and thoroughly tested for proper operation before being placed into service.

**Failure to follow these instructions can result in death or serious injury.**

1) For USA: Additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems".

**⚠ WARNING****UNINTENDED BEHAVIOR DUE TO IMPROPER ERROR HANDLING**

Improper error handling can change movements or signals or deactivate monitoring functions.

- Carefully program the error handling routines.
- Verify the effectiveness of error handling.

**Failure to follow these instructions can result in death, serious injury or equipment damage.**

**⚠ WARNING****UNINTENDED BEHAVIOR DUE TO CHANGES TO THE LIBRARY**

- Do not change or manipulate the library in any way whatsoever.

**Failure to follow these instructions can result in death, serious injury or equipment damage.**

## 1.5 Standards and terminology

Technical terms, terminology and the corresponding descriptions in this manual are intended to use the terms or definitions of the pertinent standards.

In the area of drive systems, this includes, but is not limited to, terms such as "safety function", "safe state", "fault", "fault reset", "failure", "error", "error message", "warning", "warning message", etc.

Among others, these standards include:

- IEC 61800: "Adjustable speed electrical power drive systems"
- IEC 61158: "Digital data communications for measurement and control – Fieldbus for use in industrial control systems"
- IEC 61784: "Industrial communication networks – Profiles"
- IEC 61508: "Functional safety of electrical/electronic/programmable electronic safety-related systems"

Also see the glossary at the end of this manual.

## 2 CANmotion Lexium Library Guide



*Library name* CANmotion Lexium Library

Software environment	Devices	Fieldbus
SoMachine Device Descriptions of version 3.2 and higher are supported.	LXM05 SD328 LXM32	CANmotion

The function blocks described here are used to control LXM32, LXM05 and SD328 drives in CANmotion fieldbuses under the SoMachine software environment. The function blocks are compliant with the IEC 61131-3 standard.

*Naming conventions*

- Function blocks with the prefix MC\_ ("Motion Control") are compliant with the PLCopen specifications. They conform to a global standard for programming motion control applications.
- Function blocks without a prefix are vendor-specific (Schneider Electric); however, they comply with the general PLC open rules.

*Simple application*

- The function blocks are used in the same way.
- The function blocks comply with the PLCopen state diagram.
- The function blocks feature a visualization that can be easily integrated into the application.

*Categorization of the function blocks*

- Device Function: These function blocks support you in commissioning a drive at a controller. Before these function blocks can be used, you must correctly set the communication parameters baud rate and node address.

### 2.1 List of the function blocks

Category	Subcategory	Function block	Type	LXM05	SD328	LXM32
Device Function						
	Startup	"2.2.1.1 SM_Servo_Startup"	Vendor-specific	X	-	X
		"2.2.1.2 SM_Step-Per_Startup"	Vendor-specific	-	X	-

019844113898, V2.09, 03.2012

## 2.2 Device Function

### 2.2.1 Startup

These function blocks "Startup" support you in commissioning a drive system at a controller. Before these function blocks can be used, you must set the communication parameters baud rate and node address in the drive and in the controller. Function blocks and the visualization cannot be used simultaneously.

The function blocks "Startup" with visualization elements have the following functions:

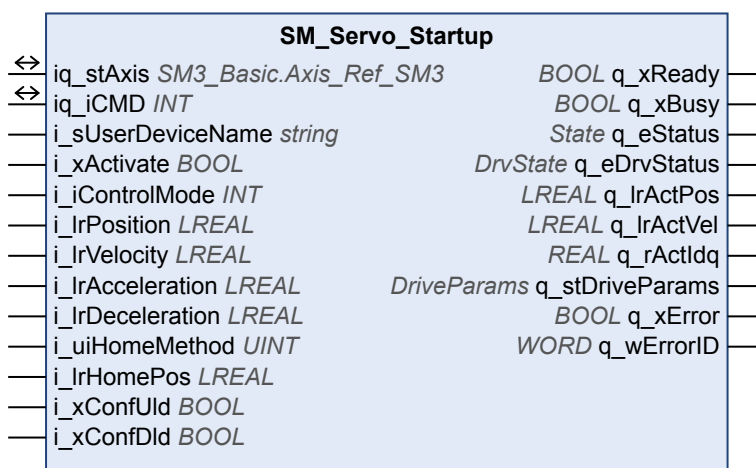
- Switching on the drive system.
- Displaying the status of the drive system.
- Fast access to frequently used parameters.
- The parameters are accessed via their index and subindex.
- Transmitting a device parameter list from the drive to the controller and from the controller to the drive (upload and download).
- Using the operating mode Jog.
- Using the operating mode Profile Velocity (movement at defined velocity).
- Displaying and acknowledging error messages.

#### 2.2.1.1 SM\_Servo\_Startup

##### *Function description*

This function block supports you in commissioning a Lexium servo drive system for the first time. The function block comprises two visualizations to facilitate usage of the function block. Function blocks and the visualization cannot be used simultaneously.

##### *Graphical representation*



*Compatible devices* LXM05 and LXM32

*Inputs/outputs* The table below shows the inputs/outputs.

Input/output	Data type	Description
iq_stAxis	Axis_Ref_LXM	Value range: Initial value: Axis structure
iq_iCMD	INT	Value range: Initial value: Commands: -1: command is active 0: no ongoing command 1: ENABLE (enable power stage) 2: DISABLE (disable power stage) 3: Reset 4: Stop 5: SetPos 6: Inc + 7: Inc - 8: MoveAbs 9: MoveVel 10: Homing  The function to be executed is written by the application as a command and overwritten by the function block when it is processed. Condition: The input is only effective if the value of Control-Mode is 1.  To start the selected function, the value in the parameter CMD must be written once. As soon as the command is executed, the value is overwritten by -1. When the execution of the command is terminated, the value is overwritten by 0.

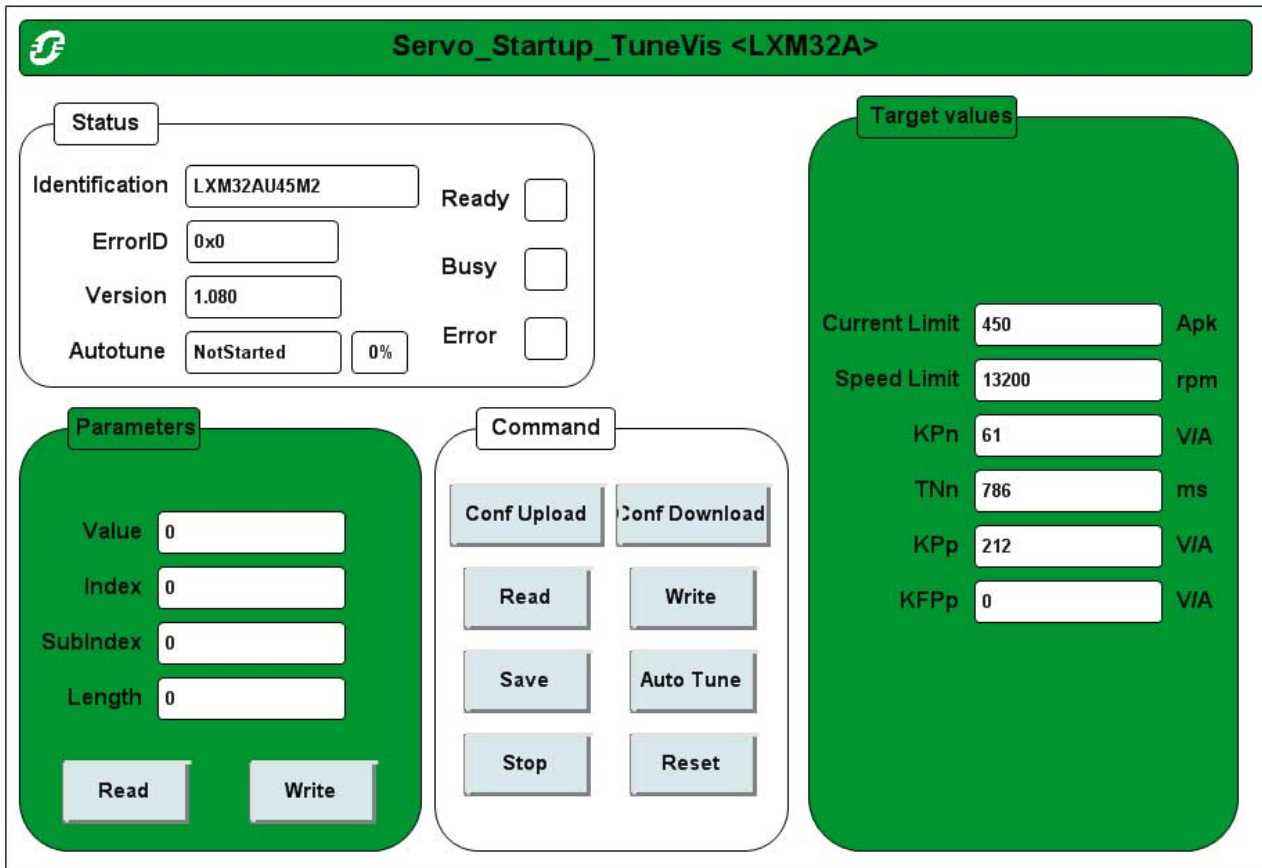
The table below shows the inputs.

Input	Data type	Description
i_sUserDeviceName	string	Value range: Initial value: Name of the axis. The name is defined by the user. If no name is entered, the node ID is displayed.
i_xActivate	BOOL	Value range: FALSE, TRUE Initial value: The selected ControlMode is activated with a rising edge. If all requirements for the selected ControlMode are met, the selected ControlMode is started. If the requirements are not met, the selection is canceled with an error message.
i_iControlMode	INT	Value range: Initial value: ControlMode = 0: The functions are controlled via the visualization. ControlMode = 1: The functions are controlled via the application. The visualization is deactivated.
i_lrPosition	DINT	Value range: Initial value: Target position in [usr]
i_lrVelocity	DINT	Value range: Initial value: Target velocity in [usr]
i_lrAcceleration	UDINT	Value range: Initial value: 600 Value for acceleration ramp in [usr].
i_lrDeceleration	UDINT	Value range: Initial value: 600 Value for deceleration ramp in [usr].
i_uiHomeMethod	UINT	Value range: Initial value: 1 Selected Homing method.
i_lrHomePos	DINT	Value range: Initial value: Position of the reference point for position setting (Homing method).
i_xConfUld	BOOL	Value range: FALSE, TRUE Initial value: A rising edge triggers an upload (saving parameters from device to controller).
i_xConfDld	BOOL	Value range: FALSE, TRUE Initial value: A rising edge triggers a download (stored parameters from controller to device).

The table below shows the outputs.

Output	Data type	Description
q_xReady	BOOL	Value range: FALSE, TRUE Initial value: Function block has been activated and is ready for operation.
q_xBusy	BOOL	Value range: FALSE, TRUE Initial value: A function is being performed via the function block. If a new function is started, the currently active function is canceled.
q_eStatus	State	Value range: Initial value: State as per PLCopen state diagram: 0: Undefined 1: Errorstop 2: Disabled 3: Stopping 4: StandStill 5: DiscreteMotion 6: ContinuousMotion 7: SynchronizedMotion 8: Homing
q_eDrvStatus	OpState	Value range: Initial value: Operating state of the drive: 1: 1 Start 2: 2 Not Ready To Switch On 3: 3 Switch On Disabled 4: 4 Ready To Switch On 5: 5 Switched On 6: 6 Operation Enabled 7: 7 Quick Stop Active 8: 8 Fault Reaction Active
q_lrActPos	DINT	Value range: Initial value: Actual position
q_lrActVel	DINT	Value range: Initial value: Actual velocity
q_rActIdq	INT	Value range: Initial value: Actual current in [A <sub>rms</sub> ]
q_stDriveParams	DriveParams	Value range: Initial value: Data structure, consisting of STRING: Device identification REAL: Firmware version of the device
q_xError	BOOL	Value range: FALSE, TRUE Initial value: FALSE: No error has been detected. TRUE: An error has been detected.
q_iErrorID	WORD	Value range: Initial value: Error number.

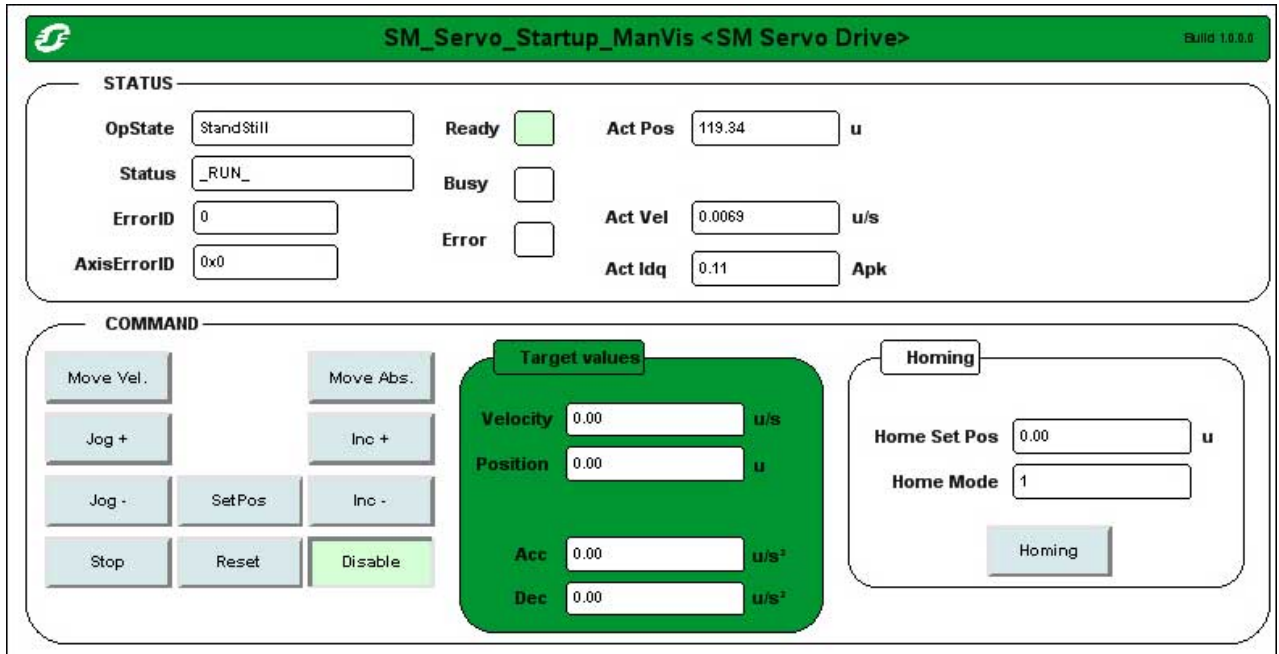
Notes



The visualization `SM_Servo_Startup_TuneVis` provides direct access to many of the parameters of the drive. The parameters are addressed by means of index and subindex. Parameter values can be read and written. An image of defined parameter values can be saved from the drive to the controller. The stored parameter values can also be transferred from the controller to the drive as a single unit.

*Visualization*  
`SM_Servo_Startup_ManVis`





The visualization `SM_Servo_Startup_ManVis` allows you to display the status of the drive. It is possible to start and stop movements.

The following operating modes can be started:

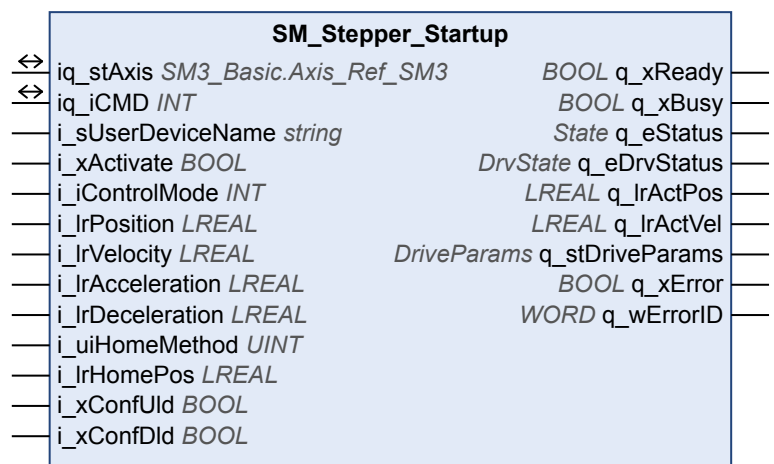
- Operating mode Jog
- Operating mode Homing
- Operating mode Profile Position (movement to defined position)
- Operating mode Profile Velocity (movement at defined velocity)

### 2.2.1.2 SM\_Stepper\_Startup

*Function description*

This function block supports you in commissioning a Lexium drive system for stepper motors for the first time. The function block comprises two visualizations to facilitate usage of the function block. Function blocks and the visualization cannot be used simultaneously.

*Graphical representation*



Compatible devices SD3

*Inputs/outputs* The table below shows the inputs/outputs.

Input/output	Data type	Description
iq_stAxis	Axis_Ref_LXM	Value range: Initial value: Axis structure
iq_iCMD	INT	Value range: Initial value: Commands: -1: command is active 0: no ongoing command 1: ENABLE (enable power stage) 2: DISABLE (disable power stage) 3: Reset 4: Stop 5: SetPos 6: Inc + 7: Inc - 8: MoveAbs 9: MoveVel 10: Homing  The function to be executed is written by the application as a command and overwritten by the function block when it is processed. Condition: The input is only effective if the value of Control-Mode is 1.  To start the selected function, the value in the parameter CMD must be written once. As soon as the command is executed, the value is overwritten by -1. When the execution of the command is terminated, the value is overwritten by 0.

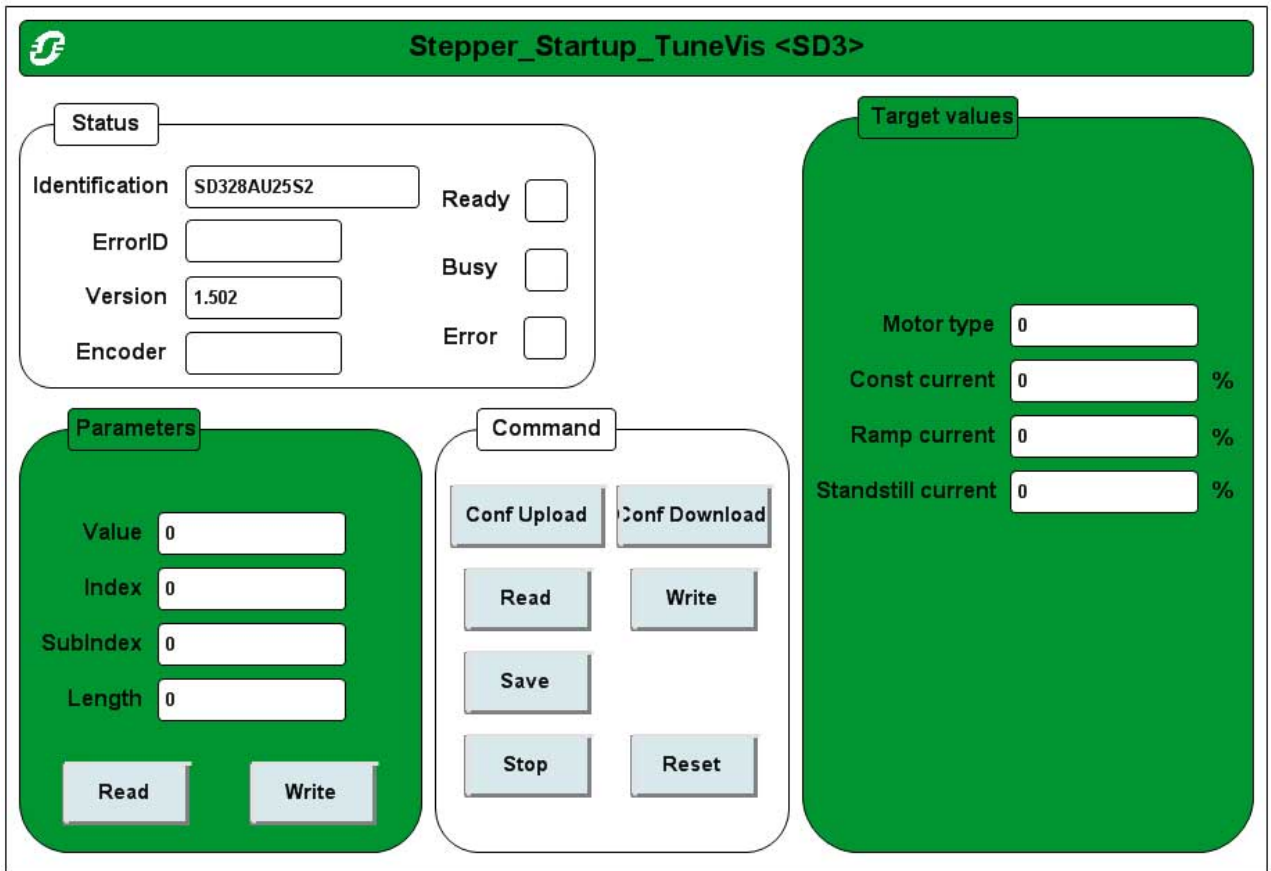
The table below shows the inputs.

Input	Data type	Description
i_sUserDeviceName	string	Value range: Initial value:  Name of the axis. The name is defined by the user. If no name is entered, the node ID is displayed.
i_xActivate	BOOL	Value range: FALSE, TRUE Initial value:  The selected ControlMode is activated with a rising edge. If all requirements for the selected ControlMode are met, the selected ControlMode is started. If the requirements are not met, the selection is canceled with an error message.
i_iControlMode	INT	Value range: Initial value:  ControlMode = 0: The functions are controlled via the visualization.  ControlMode = 1: The functions are controlled via the application. The visualization is deactivated.
i_lrPosition	DINT	Value range: Initial value:  Target position in [usr]
i_lrVelocity	DINT	Value range: Initial value:  Target velocity in [usr]
i_lrAcceleration	UDINT	Value range: Initial value: 600  Value for acceleration ramp in [usr].
i_lrDeceleration	UDINT	Value range: Initial value: 600  Value for deceleration ramp in [usr].
i_uiHomeMethod	UINT	Value range: Initial value: 1  Selected Homing method.
i_lrHomePos	DINT	Value range: Initial value:  Position of the reference point for position setting (Homing method).
i_xConfUld	BOOL	Value range: FALSE, TRUE Initial value:  A rising edge triggers an upload (saving parameters from device to controller).
i_xConfDld	BOOL	Value range: FALSE, TRUE Initial value:  A rising edge triggers a download (stored parameters from controller to device).

The table below shows the outputs.

Output	Data type	Description
q_xReady	BOOL	Value range: FALSE, TRUE Initial value: Function block has been activated and is ready for operation.
q_xBusy	BOOL	Value range: FALSE, TRUE Initial value: A function is being performed via the function block. If a new function is started, the currently active function is canceled.
q_eStatus	State	Value range: Initial value: State as per PLCOpen state diagram: 0: Undefined 1: Errorstop 2: Disabled 3: Stopping 4: StandStill 5: DiscreteMotion 6: ContinuousMotion 7: SynchronizedMotion 8: Homing
q_eDrvStatus	OpState	Value range: Initial value: Operating state of the drive: 1: <b>1</b> Start 2: <b>2</b> Not Ready To Switch On 3: <b>3</b> Switch On Disabled 4: <b>4</b> Ready To Switch On 5: <b>5</b> Switched On 6: <b>6</b> Operation Enabled 7: <b>7</b> Quick Stop Active 8: <b>8</b> Fault Reaction Active
q_lrActPos	DINT	Value range: Initial value: Actual position
q_lrActVel	DINT	Value range: Initial value: Actual velocity
q_stDriveParams	DriveParams	Value range: Initial value: Data structure, consisting of STRING: Device identification REAL: Firmware version of the device
q_xError	BOOL	Value range: FALSE, TRUE Initial value: FALSE: No error has been detected. TRUE: An error has been detected.
q_iErrorID	WORD	Value range: Initial value: Error number, see "2.3 Error handling"

Notes



The visualization `SM_Stepper_Startup_TuneVis` provides direct access to many of the parameters of the drive. The parameters are addressed by means of index and subindex. Parameter values can be read and written. An image of defined parameter values can be saved from the drive to the controller. The stored parameter values can also be transferred from the controller to the drive as a single unit.

## Visualization

SM\_Stepper\_Startup\_ManVis

The visualization `SM_Stepper_Startup_ManVis` allows you to display the status of the drive. It is possible to start and stop movements.

The following operating modes can be started:

- Operating mode Jog
- Operating mode Homing
- Operating mode Profile Position (movement to defined position)
- Operating mode Profile Velocity (movement at defined velocity)

## 2.3 Error handling

*Table of error numbers*

The table below shows the error numbers of the library. See the product manual for the error numbers of the drive.

ErrorID hexadecimal	ErrorID decimal	Error class	Description
1100 <sub>h</sub>	4352		Parameter error
6108 <sub>h</sub>	24840		Function not available
8130 <sub>h</sub>	33072		Node Guarding error
A309 <sub>h</sub>	41737		Drive not in operating state6 Operation Enabled
A31B <sub>h</sub>	41755		"HALT" requested
A338 <sub>h</sub>	41784		The operating mode is not supported by this device.
FF00 <sub>h</sub>	65280	-	Toggle bit unchanged
FF01 <sub>h</sub>	65281	-	SDO timeout
FF02 <sub>h</sub>	65282	-	Server / client command specifier invalid or unknown
FF06 <sub>h</sub>	65286	-	No memory available
FF07 <sub>h</sub>	65287	-	Access to object not possible
FF08 <sub>h</sub>	65288	-	No read access, because write-only object (wo)
FF09 <sub>h</sub>	65289	-	No write access, because read object (ro)
FF0A <sub>h</sub>	65290	-	Object does not exist in object dictionary
FF0B <sub>h</sub>	65291	-	Object does not support PDO mapping
FF0C <sub>h</sub>	65292	-	Number or length of objects exceed the byte length of the PDO
FF0D <sub>h</sub>	65293	-	Parameters are incompatible
FF0E <sub>h</sub>	65294	-	Device detects internal incompatibility
FF0F <sub>h</sub>	65295	-	Hardware error, access denied
FF10 <sub>h</sub>	65296	-	Data type and parameter length do not match
FF11 <sub>h</sub>	65297	-	Data type does not match, parameter too long
FF12 <sub>h</sub>	65298	-	Data type does not match, parameter too short
FF13 <sub>h</sub>	65299	-	Subindex not supported
FF14 <sub>h</sub>	65300	-	Value range of parameter too large (relevant only for write access)
FF15 <sub>h</sub>	65301	-	Parameter values too great
FF16 <sub>h</sub>	65302	-	Parameter values too small
FF17 <sub>h</sub>	65303	-	Upper value is less than lower value
FF18 <sub>h</sub>	65304	-	General error
FF19 <sub>h</sub>	65305	-	Data can neither be transmitted to the application nor saved.
FF1A <sub>h</sub>	65306	-	Local access channel is used, data can neither be transmitted nor saved.
FF1B <sub>h</sub>	65307	-	Device status keeps data from being transmitted and saved.
FF1C <sub>h</sub>	65308	-	Object dictionary does not exist or cannot be generated (for example, if data error occurs during generation from file)
FF20 <sub>h</sub>	65312	-	Unknown status
FF21 <sub>h</sub>	65313	-	Input variable was changed before response was received.
FF22 <sub>h</sub>	65314	-	Attempt to interrupt a non-interruptible function block.
FF23 <sub>h</sub>	65315	0	Trigger function is already active
FF24 <sub>h</sub>	65316	-	PDO timeout

ErrorID hexadecimal	ErrorID decimal	Error class	Description
FF25h	65317	-	Operating mode Electronic Gear not active
FF27h	65319	-	Drive not in state "StandStill"
FF2Ah	65322	-	Trigger event lost
FF34h	65332	-	Power stage does not switch to operating state <b>6</b> Operation Enabled
FF35h	65333	-	Incorrect program number
FF36h	65334	-	Operating mode or function is not supported
FF38h	65336	-	Parameter list has not yet been read.
FF39h	65337	-	Parameter list is not supported
FF3Bh	65339	-	Power stage is not in operating state <b>4</b> Ready To Switch On
FF3Dh	65341	-	Operating mode Motion Sequence is not active
FF3Eh	65342	-	No transition condition requested
FF3Fh	65343	-	Size of parameter list is not supported
FF50h	65360	-	Initialization error of function block.
FF51h	65361	-	The function block cannot be controlled via the application since <code>i_iControlMode = 1</code> .
FF52h	65362	-	The function block cannot be controlled via the visualization since <code>i_iControlMode = 0</code> .
FF53h	65363	-	The value at the input <code>i_iControlMode</code> is outside of the valid value range.
FF54h	65364	-	The value at the input <code>iq_iCmd</code> is outside of the valid value range.
FF55h	65365	-	The function block and the connected device are incompatible.



## 3 Glossary

# 3

### 3.1 Units and conversion tables

The value in the specified unit (left column) is calculated for the desired unit (top row) with the formula (in the field).

Example: conversion of 5 meters [m] to yards [yd]  
 $5 \text{ m} / 0.9144 = 5.468 \text{ yd}$

#### 3.1.1 Length

	<b>in</b>	<b>ft</b>	<b>yd</b>	<b>m</b>	<b>cm</b>	<b>mm</b>
<b>in</b>	-	/ 12	/ 36	* 0.0254	* 2.54	* 25.4
<b>ft</b>	* 12	-	/ 3	* 0.30479	* 30.479	* 304.79
<b>yd</b>	* 36	* 3	-	* 0.9144	* 91.44	* 914.4
<b>m</b>	/ 0.0254	/ 0.30479	/ 0.9144	-	* 100	* 1000
<b>cm</b>	/ 2.54	/ 30.479	/ 91.44	/ 100	-	* 10
<b>mm</b>	/ 25.4	/ 304.79	/ 914.4	/ 1000	/ 10	-

#### 3.1.2 Mass

	<b>lb</b>	<b>oz</b>	<b>slug</b>	<b>kg</b>	<b>g</b>
<b>lb</b>	-	* 16	* 0.03108095	* 0.4535924	* 453.5924
<b>oz</b>	/ 16	-	* $1.942559 \cdot 10^{-3}$	* 0.02834952	* 28.34952
<b>slug</b>	/ 0.03108095	/ $1.942559 \cdot 10^{-3}$	-	* 14.5939	* 14593.9
<b>kg</b>	/ 0.45359237	/ 0.02834952	/ 14.5939	-	* 1000
<b>g</b>	/ 453.59237	/ 28.34952	/ 14593.9	/ 1000	-

#### 3.1.3 Force

	<b>lb</b>	<b>oz</b>	<b>p</b>	<b>N</b>
<b>lb</b>	-	* 16	* 453.55358	* 4.448222
<b>oz</b>	/ 16	-	* 28.349524	* 0.27801
<b>p</b>	/ 453.55358	/ 28.349524	-	* $9.807 \cdot 10^{-3}$
<b>N</b>	/ 4.448222	/ 0.27801	/ $9.807 \cdot 10^{-3}$	-

#### 3.1.4 Power

	<b>HP</b>	<b>W</b>
<b>HP</b>	-	* 746
<b>W</b>	/ 746	-

## 3.1.5 Rotation

	min <sup>-1</sup> (RPM)	rad/s	deg./s
min <sup>-1</sup> (RPM)	-	* $\pi / 30$	* 6
rad/s	* $30 / \pi$	-	* 57.295
deg./s	/ 6	/ 57.295	-

## 3.1.6 Torque

	lb·in	lb·ft	oz·in	Nm	kp·m	kp·cm	dyne·cm
lb·in	-	/ 12	* 16	* 0.112985	* 0.011521	* 1.1521	* $1.129 \cdot 10^6$
lb·ft	* 12	-	* 192	* 1.355822	* 0.138255	* 13.8255	* $13.558 \cdot 10^6$
oz·in	/ 16	/ 192	-	* $7.0616 \cdot 10^{-3}$	* $720.07 \cdot 10^{-6}$	* $72.007 \cdot 10^{-3}$	* 70615.5
Nm	/ 0.112985	/ 1.355822	/ $7.0616 \cdot 10^{-3}$	-	* 0.101972	* 10.1972	* $10 \cdot 10^6$
kp·m	/ 0.011521	/ 0.138255	/ $720.07 \cdot 10^{-6}$	/ 0.101972	-	* 100	* $98.066 \cdot 10^6$
kp·cm	/ 1.1521	/ 13.8255	/ $72.007 \cdot 10^{-3}$	/ 10.1972	/ 100	-	* $0.9806 \cdot 10^6$
dyne·cm	/ $1.129 \cdot 10^6$	/ $13.558 \cdot 10^6$	/ 70615.5	/ $10 \cdot 10^6$	/ $98.066 \cdot 10^6$	/ $0.9806 \cdot 10^6$	-

## 3.1.7 Moment of inertia

	lb·in <sup>2</sup>	lb·ft <sup>2</sup>	kg·m <sup>2</sup>	kg·cm <sup>2</sup>	kp·cm·s <sup>2</sup>	oz·in <sup>2</sup>
lb·in <sup>2</sup>	-	/ 144	/ 3417.16	/ 0.341716	/ 335.109	* 16
lb·ft <sup>2</sup>	* 144	-	* 0.04214	* 421.4	* 0.429711	* 2304
kg·m <sup>2</sup>	* 3417.16	/ 0.04214	-	* $10 \cdot 10^3$	* 10.1972	* 54674
kg·cm <sup>2</sup>	* 0.341716	/ 421.4	/ $10 \cdot 10^3$	-	/ 980.665	* 5.46
kp·cm·s <sup>2</sup>	* 335.109	/ 0.429711	/ 10.1972	* 980.665	-	* 5361.74
oz·in <sup>2</sup>	/ 16	/ 2304	/ 54674	/ 5.46	/ 5361.74	-

## 3.1.8 Temperature

	°F	°C	K
°F	-	(°F - 32) * 5/9	(°F - 32) * 5/9 + 273.15
°C	°C * 9/5 + 32	-	°C + 273.15
K	(K - 273.15) * 9/5 + 32	K - 273.15	-

## 3.1.9 Conductor cross section

AWG	1	2	3	4	5	6	7	8	9	10	11	12	13
mm <sup>2</sup>	42.4	33.6	26.7	21.2	16.8	13.3	10.5	8.4	6.6	5.3	4.2	3.3	2.6

AWG	14	15	16	17	18	19	20	21	22	23	24	25	26
mm <sup>2</sup>	2.1	1.7	1.3	1.0	0.82	0.65	0.52	0.41	0.33	0.26	0.20	0.16	0.13

## 3.2 Terms and Abbreviations

See chapter "1.5 Standards and terminology" for information on the pertinent standards on which many terms are based. Some terms and abbreviations may have specific meanings with regard to the standards.

<i>Asynchronous error</i>	Asynchronous errors are signaled without a request. Example of an asynchronous error: Power stage overtemperature.
<i>Device data</i>	The term device data refers to the parameter values of a device. The data is stored in the EEPROM of the device (persistent memory).
<i>Error</i>	Discrepancy between a detected (computed, measured or signaled) value or condition and the specified or theoretically correct value or condition.
<i>Error class</i>	Classification of errors into groups. The different error classes allow for specific responses to errors, for example by severity.
<i>Factory setting</i>	Factory settings when the product is shipped
<i>Fatal error</i>	In the case of fatal error, the product is no longer able to control the motor so that the power stage must be immediately disabled.
<i>Fault</i>	Fault is a state that can be caused by an error. Further information can be found in the pertinent standards such as IEC 61800-7, ODVA Common Industrial Protocol (CIP).
<i>Fault reset</i>	A function used to restore the drive to an operational state after a detected error is cleared by removing the cause of the error so that the error is no longer active.
<i>LED</i>	Light Emitting Diode
<i>Limit switch</i>	Switches that signal overtravel of the permissible range of travel.
<i>Node guarding</i>	Monitoring of the connection to the slave at an interface for cyclic data traffic.
<i>Parameter</i>	Device data and values that can be read and set (to a certain extent) by the user.
<i>Power stage</i>	The power stage controls the motor. The power stage generates current for controlling the motor on the basis of the positioning signals from the controller.
<i>RS485</i>	Fieldbus interface as per EIA-485 which enables serial data transmission with multiple devices.
<i>Synchronous error</i>	Error signaled by the controller if it is unable to execute a command received from the master.
<i>Warning</i>	If the term is used outside the context of safety instructions, a warning alerts to a potential problem that was detected by a monitoring function. A warning does not cause a transition of the operating state.



## 4 Index

## 4

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