

Technology module



Electrical Shaft Velocity -----

Reference Manual

EN



13565768

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1 About this documentation

This documentation ...

- contains detailed information on the functionalities of the "Electrical Shaft Velocity" technology module;
- is part of the "Controller-based Automation" manual collection. It consists of the following sets of documentation:

Documentation type	Subject
Product catalogue	Controller-based Automation (system overview, sample topologies) Lenze Controller (product information, technical data)
System manuals	Visualisation (system overview/sample topologies)
Communication manuals Online helps	Bus systems • Controller-based Automation EtherCAT® • Controller-based Automation CANopen® • Controller-based Automation PROFIBUS® • Controller-based Automation PROFINET®
Reference manuals Online helps	Lenze Controllers: • Controller 3200 C • Controller c300 • Controller p300 • Controller p500
Software manuals Online helps	Lenze Engineering Tools: • »PLC Designer« (programming) • »Engineer« (parameter setting, configuration, diagnostics) • »VisiWinNET® Smart« (visualisation) • »Backup & Restore« (data backup, recovery, update)

More technical documentation for Lenze components

Further information on Lenze products which can be used in conjunction with Controller-based Automation can be found in the following sets of documentation:

Planning / configuration / technical data	
☐	Product catalogues • Controller-based Automation • Controllers • Inverter Drives/Servo Drives
Mounting and wiring	
	Mounting instructions • Controllers • Communication cards (MC-xxx) • I/O system 1000 (EPM-Sxxx) • Inverter Drives/Servo Drives • Communication modules
☐	Hardware manuals • Inverter Drives/Servo Drives
Parameter setting / configuration / commissioning	
☐	Online help/reference manuals • Controllers • Inverter Drives/Servo Drives • I/O system 1000 (EPM-Sxxx)
☐	Online help/communication manuals • Bus systems • Communication modules
Sample applications and templates	
☐	Online help / software and reference manuals • i700 application sample • Application Samples 8400/9400 • FAST Application Template Lenze/PackML • FAST technology modules

Symbols:

-  Printed documentation
- ☐ PDF file / online help in the Lenze engineering tool



Tip!

Current documentation and software updates with regard to Lenze products can be found in the download area at:

www.lenze.com

Target group

This documentation is intended for all persons who plan, program and commission a Lenze automation system on the basis of the Lenze FAST Application Software.

1 About this documentation

1.1 Document history

1.1 Document history

Version			Description
4.0	06/2019	TD29	General revisions
3.3	07/2018	TD29	General revisions
3.2	05/2017	TD17	• Content structure has been changed. • General revisions New: ▶ Torque-controlled drive as master (📖 11) ▶ Use of setpoints or actual values (📖 11)
3.1	04/2016	TD17	General revisions
3.0	10/2015	TD17	• Corrections and additions • New: L TT1P_scAP_ElectricalShaftVel[Base/State/High] (📖 24) • Content structure has been changed.
2.1	05/2015	TD17	General revisions
2.0	01/2015	TD17	• General editorial revision • Modularisation of the contents for the »PLC Designer« online help
1.0	04/2014	TD00	First edition

1 About this documentation

1.2 Conventions used

This documentation uses the following conventions to distinguish between different types of information:

Type of information	Highlighting	Examples/notes
Spelling of numbers		
Decimal separator	Point	The decimal point is always used. For example: 1234.56
Text		
Program name	» «	»PLC Designer« ...
Variable names	<i>italics</i>	By setting <i>bEnable</i> to TRUE...
Function blocks	bold	The L_MC1P_AxisBasicControl function block ...
Function libraries		The L_TT1P_TechnologyModules function library ...
Source code	Font "Courier new"	... dwNumerator := 1; dwDenominator := 1; ...
Icons		
Page reference	 6	Reference to further information: Page number in PDF file.

Variable names

The conventions used by Lenze for the variable names of Lenze system blocks, function blocks, and functions are based on the "Hungarian Notation". This notation makes it possible to identify the most important properties (e.g. the data type) of the corresponding variable by means of its name, e.g. xAxisEnabled.

1.3

Definition of the notes used

The following signal words and symbols are used in this documentation to indicate dangers and important information:

Safety instructions

Layout of the safety instructions:

**Pictograph and signal word!**

(characterise the type and severity of danger)

Note

(describes the danger and gives information about how to prevent dangerous situations)

Pictograph	Signal word	Meaning
	Danger!	Danger of personal injury through dangerous electrical voltage Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
	Danger!	Danger of personal injury through a general source of danger Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
	Stop!	Danger of property damage Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

Application notes

Pictograph	Signal word	Meaning
	Note!	Important note to ensure trouble-free operation
	Tip!	Useful tip for easy handling
		Reference to another document

2 Safety instructions

Please observe the safety instructions in this documentation when you want to commission an automation system or a plant with a Lenze Controller.



The device documentation contains safety instructions which must be observed!

Read the documentation supplied with the components of the automation system carefully before you start commissioning the Controller and the connected devices.



Danger!

High electrical voltage

Injury to persons caused by dangerous electrical voltage

Possible consequences

Death or severe injuries

Protective measures

Switch off the voltage supply before working on the components of the automation system.

After switching off the voltage supply, do not touch live device parts and power terminals immediately because capacitors may be charged.

Observe the corresponding information plates on the device.



Danger!

Injury to persons

Risk of injury is caused by ...

- unpredictable motor movements (e.g. unintended direction of rotation, too high velocities or jerky movement);
- impermissible operating states during the parameterisation while there is an active online connection to the device.

Possible consequences

Death or severe injuries

Protective measures

- If required, provide systems with installed inverters with additional monitoring and protective devices according to the safety regulations valid in each case (e.g. law on technical equipment, regulations for the prevention of accidents).
- During commissioning, maintain an adequate safety distance to the motor or the machine parts driven by the motor.



Stop!

Damage or destruction of machine parts

Damage or destruction of machine parts can be caused by ...

- Short circuit or static discharges (ESD);
- unpredictable motor movements (e.g. unintended direction of rotation, too high velocities or jerky movement);
- impermissible operating states during the parameterisation while there is an active online connection to the device.

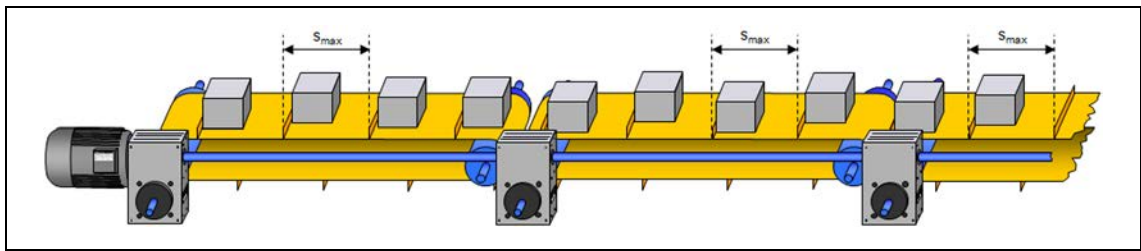
Protective measures

- Always switch off the voltage supply before working on the components of the automation system.
- Do not touch electronic components and contacts unless ESD measures were taken beforehand.
- If required, provide systems with installed inverters with additional monitoring and protective devices according to the safety regulations valid in each case (e.g. law on technical equipment, regulations for the prevention of accidents).

3 Functional description of "Electrical Shaft Velocity"

3.1 Overview of the functions

3 Functional description of "Electrical Shaft Velocity"



[3-1] Typical mechanics of the technology module

- In the "Base" version, the synchronism and the setting of an offset are activated with a velocity jump.
- In the "State" version it is additionally possible to clutch-in jump-free. For this purpose, a velocity-dependent clutch is used. Moreover, an offset can be set between master and slave axis by trimming by analogy with the manual jog function. The absolute-acting offset is immediately accepted with a velocity jump.
- In addition to the State version, the "High" version provides a synchronism with basic velocity and a jump-free connection of the position offset using a profile generator.

► [Overview of the functions](#) (10)

3.1 Overview of the functions

In addition to the basic functions for operating the **L_MC1P_AxisBasicControl** function block, the **Stop** function and the **Holding** function, the technology module offers the following functionalities that are assigned to the "Base", "State", and "High" versions:

Functionality	Versions		
	Base	State	High
Manual jog (jogging) (25)	●	●	●
Synchronism (SyncVel) (26)	●	●	●
Velocity offset during synchronism (28)	●	●	●
Synchronism with clutch-in/declutch mechanism (29)		●	●
Position trimming (30)		●	●
Velocity offset with profile generator (31)			●
Synchronism with basic velocity (32)			●



»PLC Designer« Online help

Here you will find detailed information on the **L_MC1P_AxisBasicControl** function block, the **stop** function and the **holding** function.

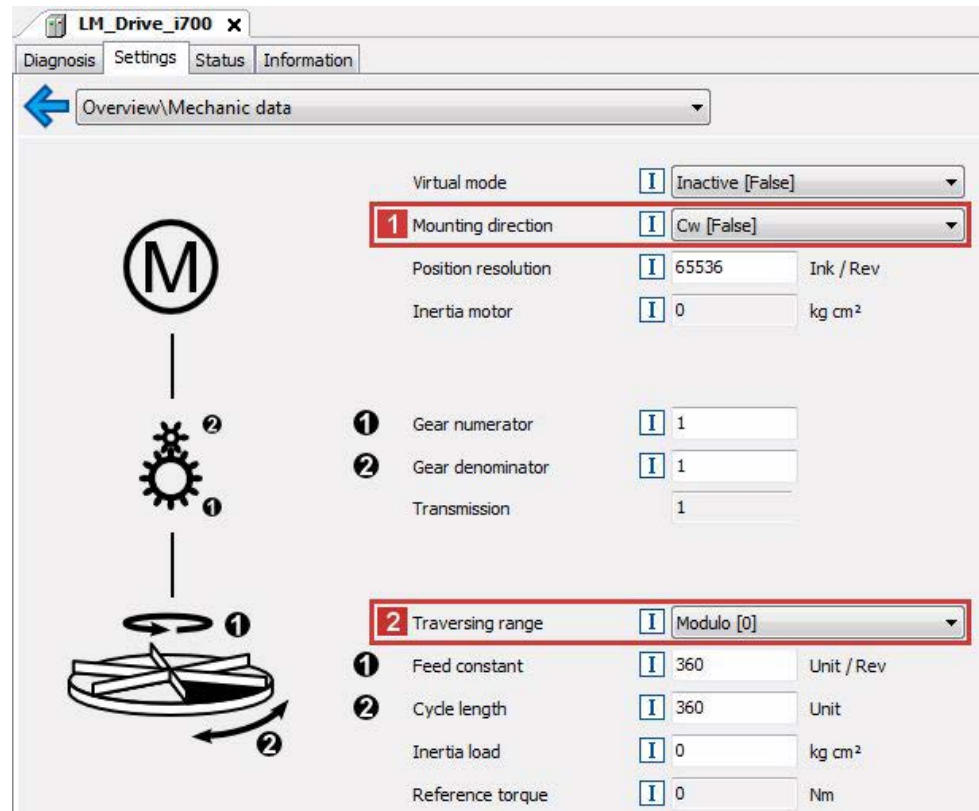
3.2

Important notes on how to operate the technology module

The "Electrical Shaft Velocity" technology module only supports lineary and rotary axes:

- the master and the slave axis must either be both a lineary axis or both a rotary axis.

Go to the »PLC Designer« and set the "Modulo" machine measuring system for each axis under the **Settings** tab:



Setting of the operating mode

The operating mode for the slave axis has to be set to "cyclically synchronous speed" (csv) because the axis is led via the speed conductivity.

Torque-controlled drive as master

In its function as master, the technology module can also have an axis which runs in the cyclic sync torque mode (cst).

The actual values are written to the setpoints.

Use of setpoints or actual values

The technology module uses the setpoint of the master axis.

The `L_MC1P_AverageFilterSetValue` filter function can be used to influence the setpoints, making it possible for the technology module to switch over to the actual values.

Controlled start of the axes

Motion commands that are set in the inhibited axis state ($xAxisEnabled = FALSE$) after enable ($xRegulatorOn = TRUE$) must be activated again by a $FALSE \rightarrow TRUE$ edge.

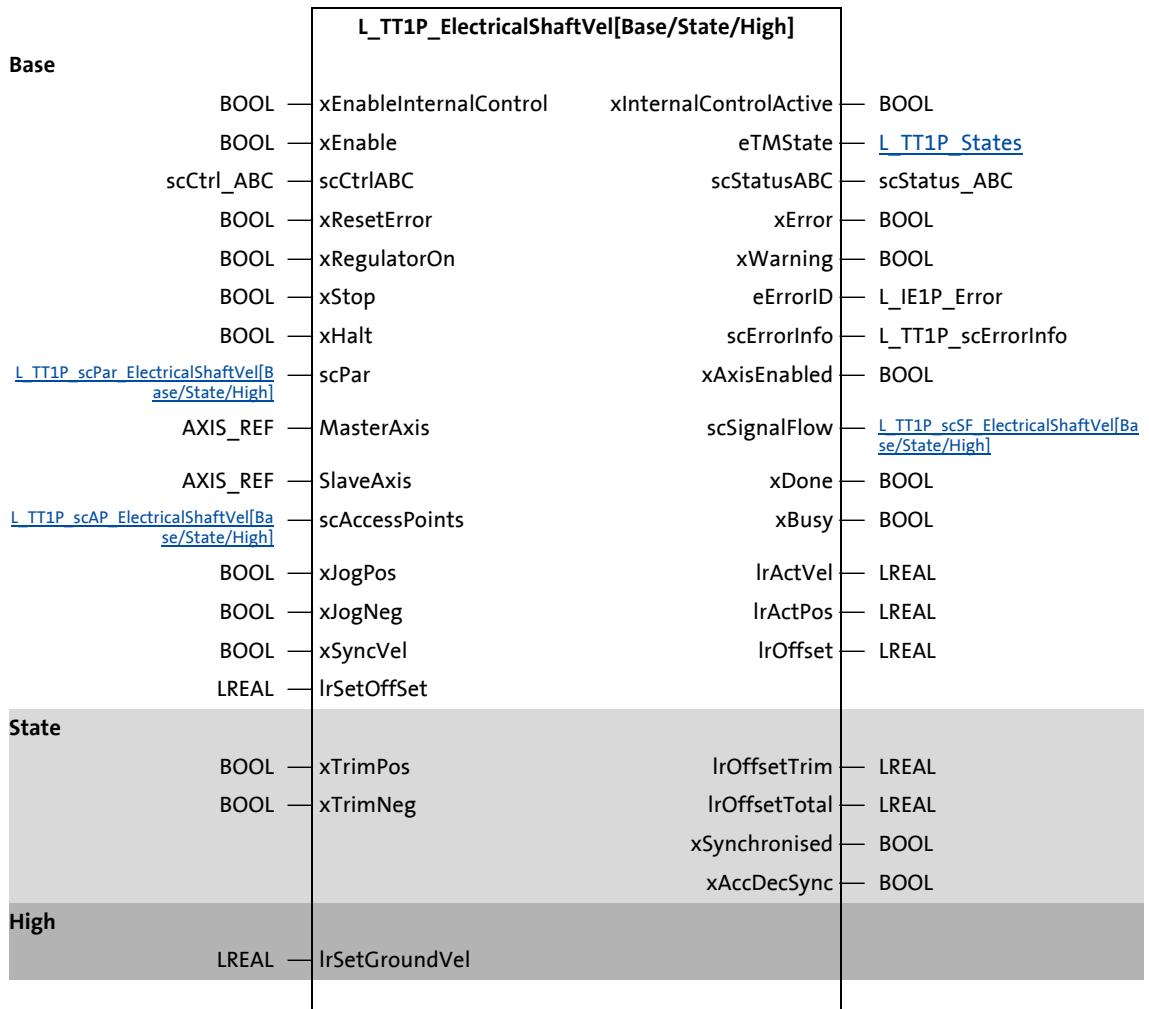
In this way it is prevented that the drive starts in an uncontrolled manner after controller enable.

**Example [Manual jog \(jogging\)](#) (📖 25):**

1. In the inhibited axis state ($xAxisEnabled = FALSE$), $xJogPos$ is set to TRUE.
 - $xRegulatorOn = FALSE$ (axis is inhibited.)
==> "READY" state ($xAxisEnabled = FALSE$)
 - $xJogPos = TRUE$ (manual jog is to be executed.)
2. Enable axis.
 - $xRegulatorOn = TRUE$
==> "READY" state ($xAxisEnabled = TRUE$)
3. Execute manual jog.
 - $xJogPos = FALSE \rightarrow TRUE$
==> "JOGPOS" state

3.3 Function block L_TT1P_ElectricalShaftVel[Base/State/High]

The figure shows the relation of the inputs and outputs to the "Base", "State" and "High" versions. The additional inputs and outputs of the "State" and "High" versions are shaded.



3.3.1 Inputs and outputs

Designator	Data type	Description	Available in version		
			Base	State	High
MasterAxis	AXIS_REF	Reference to the master axis (master axis)	●	●	●
SlaveAxis	AXIS_REF	Reference to the slave axis	●	●	●

3.3.2 Inputs

Designator	Data type	Description		Available in version		
				Base	State	High
xEnableInternalControl	BOOL	TRUE	In the visualisation, the internal control of the axis can be selected via the "Internal Control" axis.	●	●	●
xEnable	BOOL	Execution of the function block		●	●	●
		TRUE	The function block is executed.			
		FALSE	The function block is not executed.			
scCtrlABC	scCtrl_ABC	Input structure for the L_MC1P_AxisBasicControl function block - scCtrlABC can be used in "Ready" state. - If there is a request, the state changes to "Service". - The state change from "Service" back to "Ready" takes place if there are no more requests.		●	●	●
xResetError	BOOL	TRUE	Reset axis error or software error.	●	●	●
xRegulatorOn	BOOL	TRUE	Activate controller enable of the axis (via the MC_Power function block).	●	●	●
xStop	BOOL	TRUE	Cancel the active movement and brake the axis to a standstill with the deceleration defined via the IrStopDec parameter. - The state changes to "Stop". - The STOP state is exited if (Not xStop AND Not xHalt) AND eAxisState = StandStill - The input is also active with "Internal Control".	●	●	●
xHalt	BOOL	TRUE	Cancel the active movement and brake the axis to a standstill with the deceleration defined via the IrHaltDec parameter. - The state changes to "Stop". - The technology module remains in the "Stop" state as long as xStop is set to TRUE (or xHalt = TRUE).	●	●	●
scPar	The parameter structure contains the parameters of the technology module. The data type depends on the version used (Base/State/High).			●	●	●
scAccessPoints	Structure of the access points The data type depends on the version used (Base/State/High).			●	●	●
xJogPos	BOOL	TRUE	Traverse axis in positive direction (manual jog). If xJogNeg is also TRUE, the traversing direction selected first remains set.	●	●	●
xJogNeg	BOOL	TRUE	Traverse axis in negative direction (manual jog). If xJogPos is also TRUE, the traversing direction selected first remains set.	●	●	●

Designator	Data type	Description		Available in version		
				Base	State	High
xSyncVel	BOOL	Synchronisation of the slave axis to the master axis		●	●	●
		TRUE	Base: Synchronisation without clutch function			
			State/High: Synchronisation with velocity clutch			
lrSetOffsetSlave	LREAL	Velocity offset to master axis The position is approached in the "VEL_IS_SYNCHRONISED" state when the value changes • Initial value: 0 • Unit: units/s		●	●	●
		Base/ State	The offset is directly applied.			
		High	The offset is assigned via the profile generator.			
xTrimPos	BOOL	TRUE	Trim velocity in positive direction. If xTrimNeg is also TRUE, the traversing direction selected first remains set.		●	●
xTrimNeg	BOOL	TRUE	Trim velocity in negative direction. If xTrimPos is also TRUE, the traversing direction selected first remains set.		●	●
lrSetGroundVel	LREAL	Basic velocity The velocity specified is transmitted to the axis when the clutch is open. • Unit: units/s				●

3.3.3 Outputs

Designator Data type	Description		Available in version		
			Base	State	High
xInternalControlActive BOOL	TRUE	The internal control of the axis is activated via the visualisation. (xEnableInternalControl input = TRUE)	●	●	●
eTMState L_TT1P_States	Current state of the technology module ► State machine (□ 20)		●	●	●
scStatusABC scStatus_ABC	Structure of the status data of the L_MC1P_AxisBasicControl function block		●	●	●
xError BOOL	TRUE	There is an error in the technology module.	●	●	●
xWarning BOOL	TRUE	There is a warning in the technology module.	●	●	●
eErrorID L_IE1P_Error	ID of the error or warning message if xError = TRUE or xWarning = TRUE. "FAST technology modules" reference manual: Here you can find information on error or warning messages.		●	●	●
scErrorInfo L_TT1P_scErrorInfo	Error information structure for a more detailed analysis of the error cause		●	●	●
scSignalFlow L_TT1P_scSF_ElectricalShaftVel[Base/State/High]	Structure of the signal flow The data type depends on the version used (Base/State/High). ► Signal flow diagram (□ 22)		●	●	●
xAxisEnabled BOOL	TRUE	The axis is enabled.	●	●	●
xDone BOOL	TRUE	The request/action has been completed successfully.	●	●	●
xBusy BOOL	TRUE	The request/action is currently being executed.	●	●	●
IrActVel LREAL	Current velocity • Unit: units/s		●	●	●
IrActPos LREAL	Current position • Unit: units		●	●	●
IrOffset LREAL	Set velocity offset from the IrSetOffsetSlave input between the master axis and the slave axis • Unit: units/s		●	●	●
IrOffsetTrim LREAL	Velocity offset from the trimming function between the master axis and the slave axis • Unit: units/s			●	●
IrOffsetTotal LREAL	Total velocity offset between the master axis and the slave axis • Unit: units/s			●	●
xSynchronised BOOL	TRUE	The axis is coupled with reference to the master axis.		●	●
xAccDecSync BOOL	TRUE	The synchronisation function is active. The axis is synchronised or desynchronised (clutch opens or closes).		●	●

3.3.4 Parameters

L_TT1P_scPar_ElectricalShaftVel[Base/State/High]

The L_TT1P_scPar_ElectricalShaftVel[Base/State/High] structure contains the parameters of the technology module.

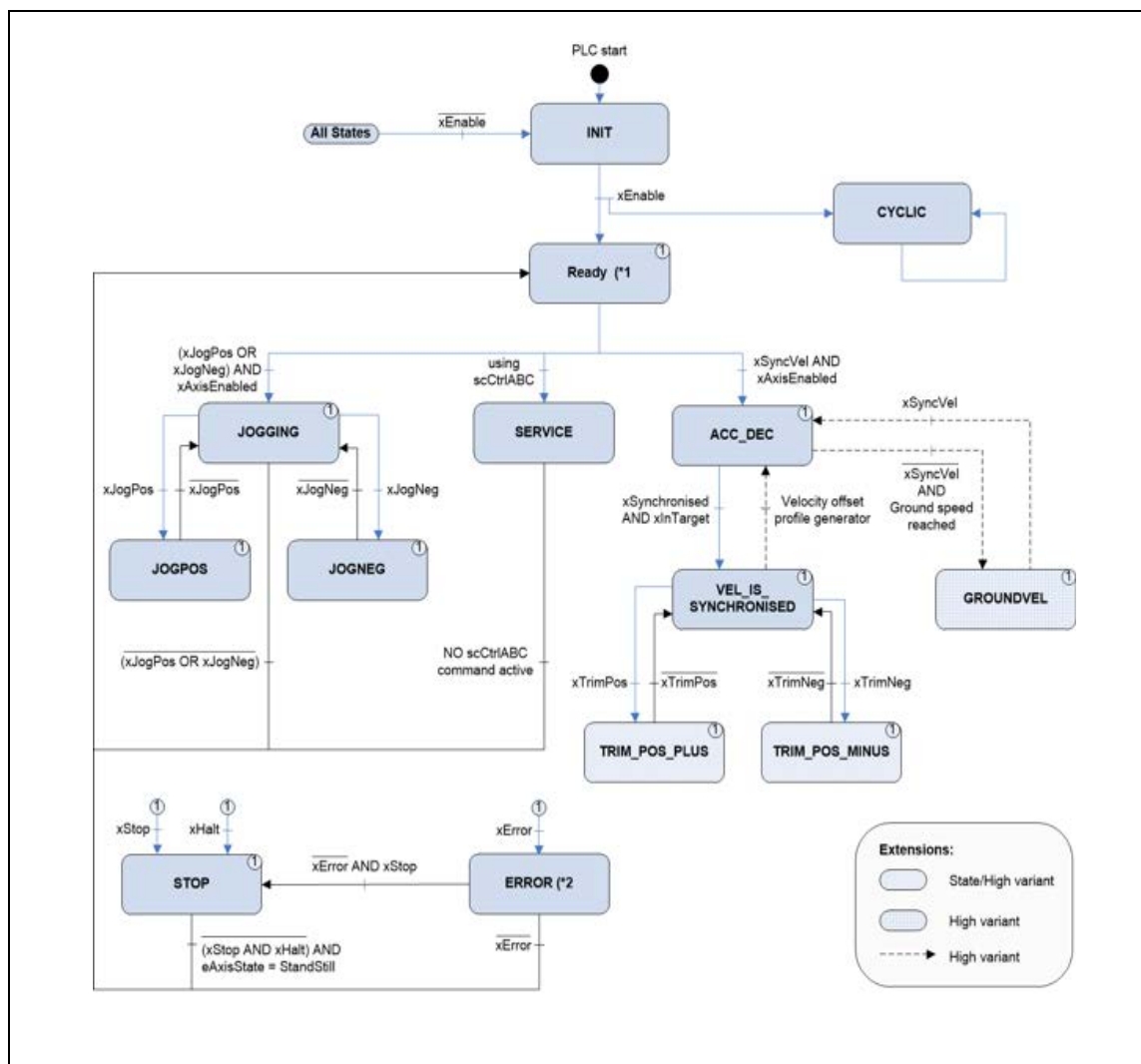
Designator	Data type	Description	Available in version		
			Base	State	High
IrStopDec	LREAL	Deceleration for the stop function and when hardware/software limit switches and the following error monitoring function are triggered • Unit: units/s ² • Initial value: 10000	●	●	●
IrStopJerk	LREAL	Jerk for the stop function and for the triggering of the hardware limit switches, software limit positions, and the following error monitoring function • Unit: units/s ³ • Initial value: 100000	●	●	●
IrHaltDec	LREAL	Deceleration for the holding function Specification of the maximum speed variation which is to be used for deceleration to standstill. • Unit: units/s ² • Initial value: 3600 • Only positive values are permissible.	●	●	●
IrJerk	LREAL	Jerk for compensating an offset value, trimming, clutch, or holding function • Unit: units/s ³ • Initial value: 100000	●	●	●
IrJogJerk	LREAL	Jerk for manual jog • Unit: units/s ³ • Initial value: 10000	●	●	●
IrJogVel	LREAL	Maximum speed to be used for manual jog. • Unit: units/s • Initial value: 10	●	●	●
IrJogAcc	LREAL	Acceleration for manual jog Specification of the maximum velocity variation which is to be used for acceleration. • Unit: units/s ² • Initial value: 100	●	●	●
IrJogDec	LREAL	Deceleration for manual jog Specification of the maximum speed variation which is to be used for deceleration to standstill. • Unit: units/s ² • Initial value: 100	●	●	●
dwCouplingMode	DWORD	Mode for coupling measuring systems X and Y • Initial value: 1 (coupling over cycle lengths)	●	●	●
		0 Unit clutch			
		1 Coupling via cycle lengths			
IrCouplingX	LREAL	Coupling factor for the X axis • The setting of the parameter is effective in the "unit coupling" (dwCouplingMode = 0). • Changes of the parameter are accepted in the "Ready" state. • In a clutched-in state, the coupling factor cannot be changed via the parameter. The coupling factor can only be changed via the access points L_TT1P_scAP_ElectricalShaftVel[Base/State/High] (□ 24). • Initial value: 1	●	●	●

Designator	Data type	Description	Available in version		
			Base	State	High
IrCouplingY	LREAL	Coupling factor for the Y axis - The setting of the parameter is effective in the "unit coupling" (dwCouplingMode = 0). - Changes of the parameter are accepted in the "Ready" state. - In a clutched-in state, the coupling factor cannot be changed via the parameter. The coupling factor can only be changed via the access points L_TT1P_scAP_ElectricalShaftVel[Base/State/High] (□ 24). - Initial value: 1	●	●	●
IrTrimAcc	LREAL	Acceleration for trimming Selection of the velocity change relative to the master to be used for accelerating. The acceleration acting on the drive is the sum of master and slave acceleration. - Unit: units/s² - Initial value: 100		●	●
IrTrimDec	LREAL	Deceleration for trimming Selection of the velocity change relative to the master to be used for decelerating. The deceleration acting on the drive is the sum of master and slave deceleration. - Unit: units/s² - Initial value: 100		●	●
IrTrimVel	LREAL	Velocity for trimming Selection of the velocity used for trimming. - Unit: units/s - Initial value: 50		●	●
IrSyncOutAcc	LREAL	Acceleration for declutching - Base/State: Deceleration ramp for travelling to a standstill - High: Synchronisation to the IrSetGroundVel basic velocity		●	●
		- Unit: units/s² - Initial value: 100 - Value 0.0 units/s²: Maximum acceleration (the difference in velocity is reached in one cycle.)			
IrSyncInAcc	LREAL	Acceleration for clutching-in - Acceleration ramp for synchronising the master velocity. - Value 0.0 units/s²: Maximum acceleration (the difference in velocity is reached in one cycle.) - Unit: units/s² - Initial value: 100		●	●
IrSyncJerk	LREAL	Jerk for clutch-in and declutch function - Unit: units/s³ - Initial value: 10000		●	●
IrOffsetAcc	LREAL	Acceleration for ramp generation - Value 0.0 units/s²: Maximum acceleration (the difference in velocity is reached in one cycle.) - Unit: units/s² - Initial value: 100			●

Designator	Data type	Description	Available in version		
			Base	State	High
IrOffsetDec	LREAL	Deceleration for ramp generation • Value 0.0 units/s²: Maximum deceleration (the difference in velocity is reached in one cycle.) • Unit: units/s² • Initial value: 100			●
IrOffsetJerk	LREAL	Jerk for ramp generation • Value 0 units/s³: Jerk limitation deactivated (Use of linear acceleration ramps) • Unit: units/s³ • Initial value: 10000			●

3.4

State machine



[3-2] State machine of the technology module

① A transition to the ERROR or STOP state is possible.

(*1 In the "Ready" state, xRegulatorOn has to be set to TRUE.

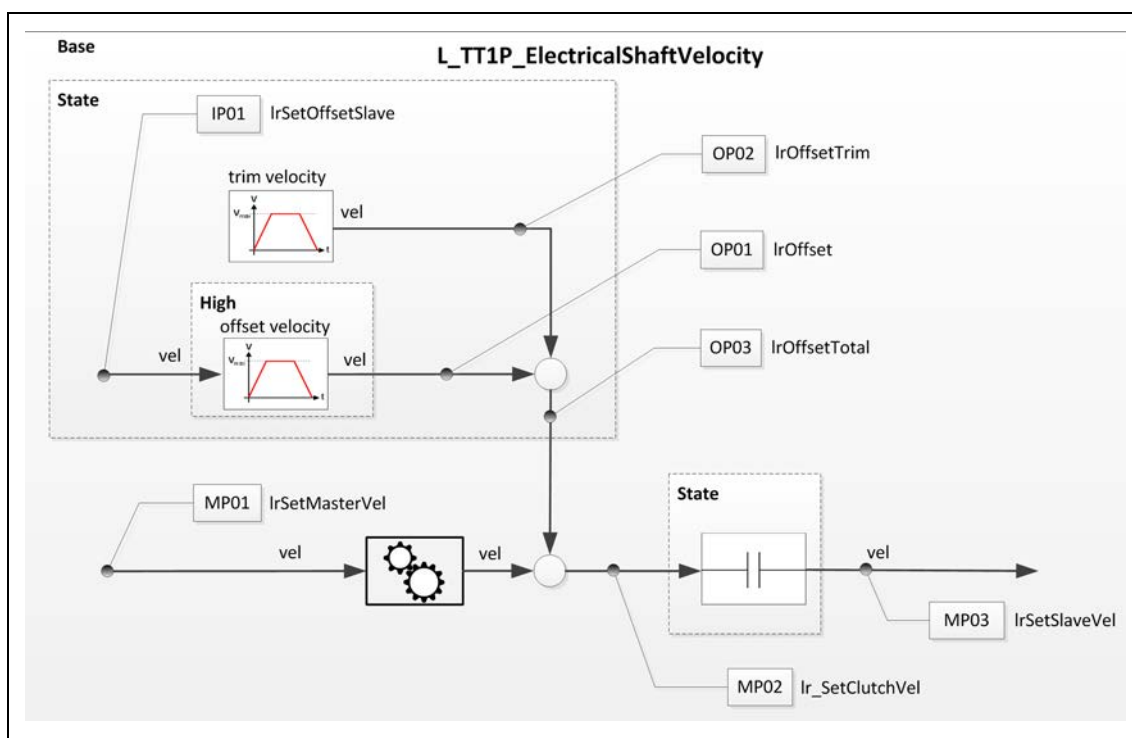
(*2 In the "ERROR" state, xResetError has to be set to TRUE in order to acknowledge and reset the errors.

States of the eTMState output (L_TT1P_States)

No.	L_TT1P_States	Description
1	INIT	Initialisation of the technology module active.
2	READY	Technology module ready for operation.
3	HOMING	Referencing active.
10	JOGGING	Manual jog active.
11	JOGPOS	Manual jog in positive direction active.
12	JOGNEG	Manual jog in negative direction active.
20	POSITION_TRIMMING	Position trimming active.
21	TRIM_POS_PLUS	Position trimming in positive direction active.
22	TRIM_POS_MINUS	Position trimming in negative direction active.
30	SYNCHRONISING_POS	Position coupling active.
31	POS_IS_SYNCHRONISED	Position coupling closed, position synchronism active.
40	SYNCHRONISING_VEL	Speed coupling active.
41	VEL_IS_SYNCHRONISED	Speed coupling closed, speed synchronism active.
51	GROUNDSPPEED	Ground speed active.
52	ACC_DEC	Coupling active: Coupling opens or closes.
996	STOP	Stop/Halt active.
998	SERVICE	The technology module is in service mode. The internal L_MC1P_AxisBasicControl function block is controlled via the <i>scCtrlABC</i> input structure. The status of the function block can be viewed via the <i>scStatusABC</i> output structure.
999	ERROR	Error state
1000	SYSTEMFAULT	System fault

3.5

Signal flow diagram



[3-3] Signal flow diagram

The illustration [\[3.5\]](#) shows the main signal flow of the implemented functions.

The signal flow of the additional functions such as "manual jog" is not displayed here.

3.5.1 Structure of the signal flow

L_TT1P_scSF_ElectricalShaftVel[Base/State/High]

The contents of the L_TT1P_scSF_ElectricalShaftVel[Base/State/High] structure are read-only and offer a practical diagnostics option within the signal flow ([Signal flow diagram](#) (□ 22)).

Designator	Data type	Description	Available in version		
			Base	State	High
IP01_IrSetOffsetSlave	LREAL	Velocity offset to master axis The position is approached in the "VEL_IS_SYNCHRONISED" state when the value changes • Unit: units/s	●	●	●
		Base/ State			
		High			
MP01_IrSetMasterVel	LREAL	Setpoint velocity of the master axis • Unit: units/s	●	●	●
MP02_IrSetClutchVel	LREAL	Master velocity for the clutch • Unit: units/s	●	●	●
MP03_IrSetSlaveVel	LREAL	Setpoint velocity of the slave axis • Unit: units/s	●	●	●
OP01_IrOffset	LREAL	Set velocity offset from the IrSetOffsetSlave input between the master axis and the slave axis • Unit: units/s	●	●	●
OP02_IrOffsetTrim	LREAL	Velocity offset from the trimming function between the master axis and the slave axis • Unit: units/s		●	●
OP03_IrOffsetTotal	LREAL	Total velocity offset between the master axis and the slave axis • Unit: units/s		●	●

3.5.2 Structure of the access points

L_TT1P_scAP_ElectricalShaftVel[Base/State/High]

The access points (AP) can be used to influence signals. In the initial state, the access points do not have any effect.

Each access point acts as an alternative branch and is activated via an OR operation or a switch.

Designator	Data type	Description		Available in version		
				Base	State	High
AP01_xCouplingX	BOOL	Enable of the AP01_xCouplingX access point		●	●	●
		TRUE	The access point overwrites the values at the access point in the signal flow. The coupling factor in the IrCouplingX parameter becomes ineffective.			
AP01_IrCouplingX	LREAL	Active coupling factor for the X axis - The setting of the parameter is effective in the "unit coupling" (dwCouplingMode = 0). - The coupling factor can also be changed cyclically in a clutched-in state.				
AP02_xCouplingY	BOOL	Enable of the AP01_xCouplingY access point		●	●	●
		TRUE	The access point overwrites the values at the access point in the signal flow. The coupling factor in the IrCouplingY parameter becomes ineffective.			
AP02_IrCouplingY	LREAL	Active coupling factor for the Y axis - The setting of the parameter is effective in the "unit coupling" (dwCouplingMode = 0). - The coupling factor can also be changed cyclically in a clutched-in state.				

3.6 Manual jog (jogging)

Precondition

- The technology module is in the "Ready" state.
- The slave axis is enabled ($xRegulatorOn = TRUE$).

Execution

For manual jog of the axis, the manual jog speed $lrJogVel$ is used.

If the $xJogPos$ input is TRUE, the axis is traversed in positive direction and if the $xJogNeg$ input is TRUE, the axis is traversed in negative direction. The axis is executed for as long as the input remains set to TRUE.

The current travel command cannot be replaced by another jog command. Only if both inputs have been reset, the [State machine](#) (□ 20) changes to the "Ready" state again.

Parameters to be set

The parameters for the manual jog are located in the [L TT1P_scPar_ElectricalShaftVel\[Base/State/High\]](#) (□ 17) parameter structure.

```
lrJogVel : LREAL := 10;    // Velocity [units/s]
lrJogAcc : LREAL := 100;   // Acceleration [units/s^2]
lrJogDec : LREAL := 100;   // Deceleration [units/s^2]
lrJogJerk : LREAL := 10000; // Jerk [units/s^3]
```

The parameter values can be changed during operation. They are accepted when the $xJogPos$ or $xJogNeg$ input is set to TRUE again.

3.7

Synchronism (SyncVel)

**Note!**

A coupling procedure requires the master axis and slave axis to be at standstill. Running axes cause a velocity jump.

Execution

For synchronising the slave axis and master axis, the slave velocity is directly coupled to the master velocity by means of the coupling factor.

The coupling factor can either be defined by unit coupling or set cycle lengths.

- Coupling factor = $lrCouplingY / lrCouplingX$
- Coupling factor = cycle length of the slave axis / cycle length of the master axis

The coupling mode is set via the *dwCouplingMode* parameter.

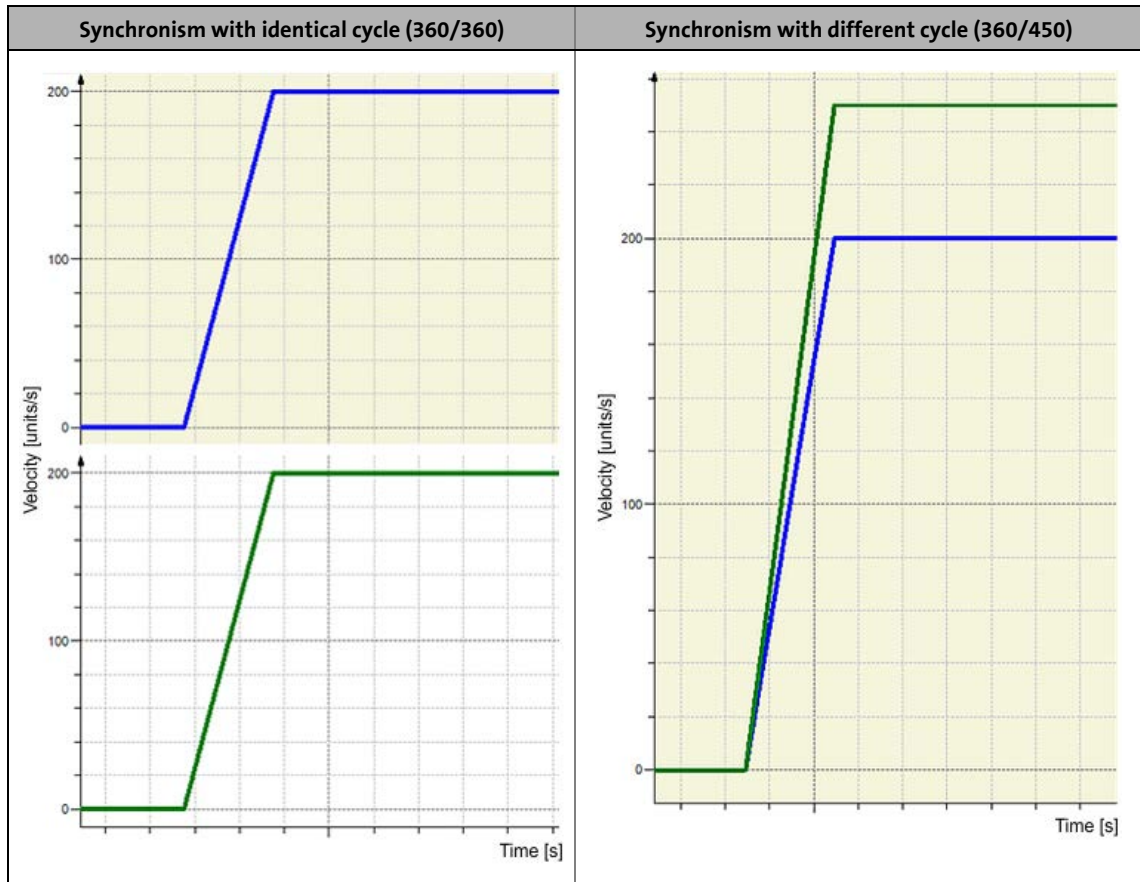
The cycle lengths are set in the axes.

Parameters to be set

The parameters for coupling are located in the [L_TT1P_scPar_ElectricalShaftVel\[Base/State/High\] \(17\)](#) parameter structure.

```
dwCouplingMode : DWORD := 1; // 0: Unit coupling, 1: Coupling via cycle lengths
lrCouplingX : LREAL := 1;
lrCouplingY : LREAL := 1;
```

Examples



3.8 Velocity offset during synchronism



Note!

A velocity offset is set with a velocity jump.

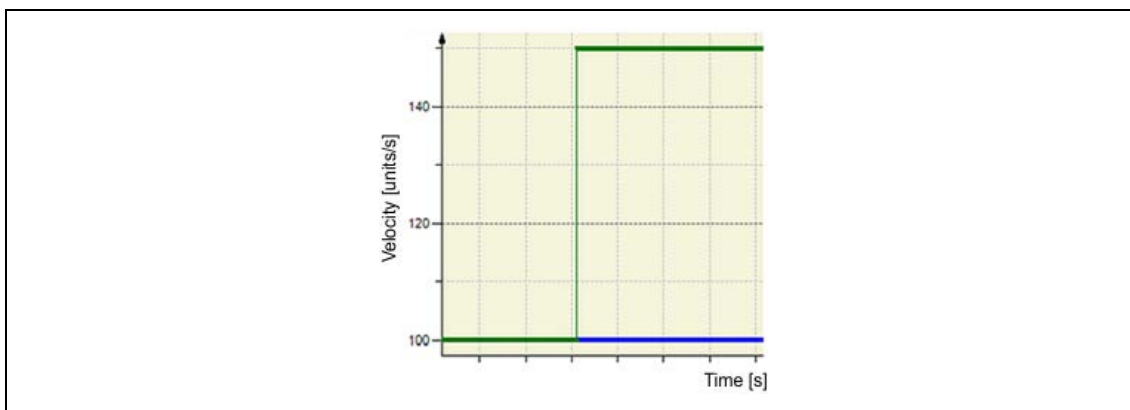
Precondition

Setting a velocity offset is only possible in the "VEL_IS_SYNCHRONISED" state.

Execution

A variable velocity offset between master and slave is defined with the *IrSetOffsetSlave* input. In the "VEL_IS_SYNCHRONISED" state and with a changed value, the offset is abruptly connected to the setpoint velocity of the axis.

Example



[3-4] Velocity offset *IrSetOffsetSlave* = 50

3.9 Synchronism with clutch-in/declutch mechanism

Execution

The synchronism of slave axis and master axis is extended by a clutch function. The clutch function synchronises the velocity of the slave axis to the master velocity of the master axis. Here, positioning takes place jump-free.

Clutch-in starts at any position when $xSyncVel = TRUE$.

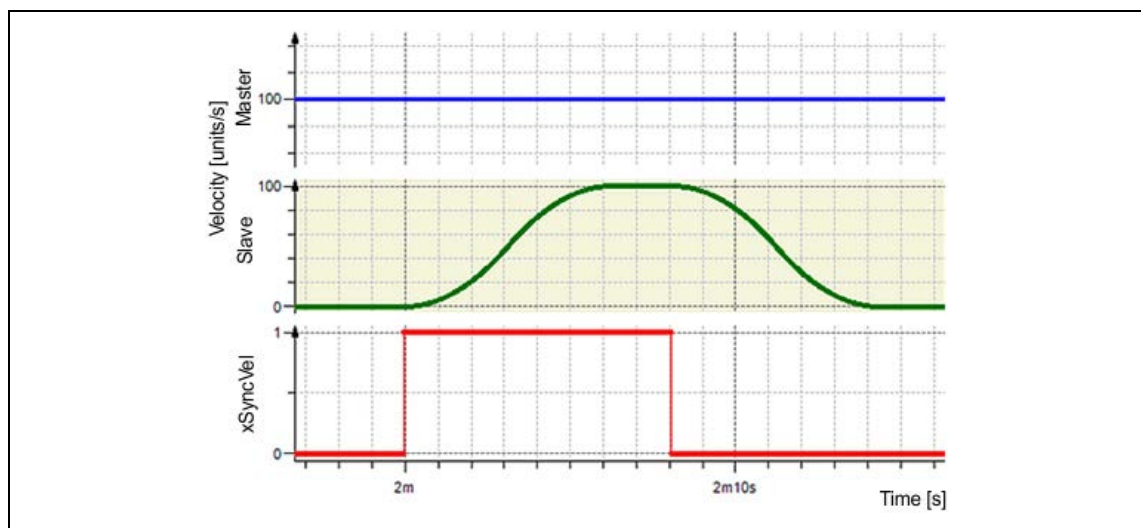
When declutching with $xSyncVel = FALSE$, the drive is braked to standstill at the $lrSyncOutAcc$ deceleration and changed to the "Ready" state.

Parameters to be set

The parameters for the clutch function are located in the [L TT1P_scPar_ElectricalShaftVel\[Base/State/High\]](#) (□ 17) parameter structure.

```
lrSyncOutAcc : LREAL := 10.0;
lrSyncInAcc  : LREAL := 10.0;
lrSyncJerk   : LREAL := 10000;
```

Example



[3-5] Clutch-in/declutch process

[3-5] shows the clutch-in/declutch process from standstill to the velocity of 100.0 units/s and back again to standstill.

3.10 Position trimming

Precondition

The position trimming is only possible in the "VEL_IS_SYNCHRONISED" state.

Execution

Position trimming enables the position of the slave axis to be adjusted towards the master axis by "tipping" - by analogy with [Manual jog \(jogging\)](#) (☰ 25).

Position trimming is started by setting the input *xTrimPos* or *xTrimNeg* to TRUE. The "VEL_IS_SYNCHRONISED" state then changes to "TRIM_POS_PLUS" or "TRIM_POS_MINUS", depending on the direction, and only leaves it when the respective input *xTrimPos* or *xTrimNeg* is reset to FALSE.

Offsets adjusted by trimming can be detected via the *lrOffsetTrim* output.

Parameters to be set

The parameters for position trimming are located in the [L_TT1P_scPar_ElectricalShaftVel\[Base/State/High\]](#) (☰ 17) parameter structure.

```
lrJerk      : LREAL := 10000;
lrTrimAcc   : LREAL := 100;
lrTrimDec   : LREAL := 100;
lrTrimVel   : LREAL := 50;
```

The acceleration and velocity of the trimming superimpose the ones of the master axis. Hence, the results for the axis to be trimmed are as follows:

- Resulting velocity of: $v_{AxisRes} = v_{MasterAxis} + lrTrimVel$
- Resulting acceleration of: $a_{AxisRes} = a_{MasterAxis} + lrTrimAcc$

3.11 Velocity offset with profile generator

Precondition

Setting a velocity offset is only possible in the "VEL_IS_SYNCHRONISED" state.

Execution

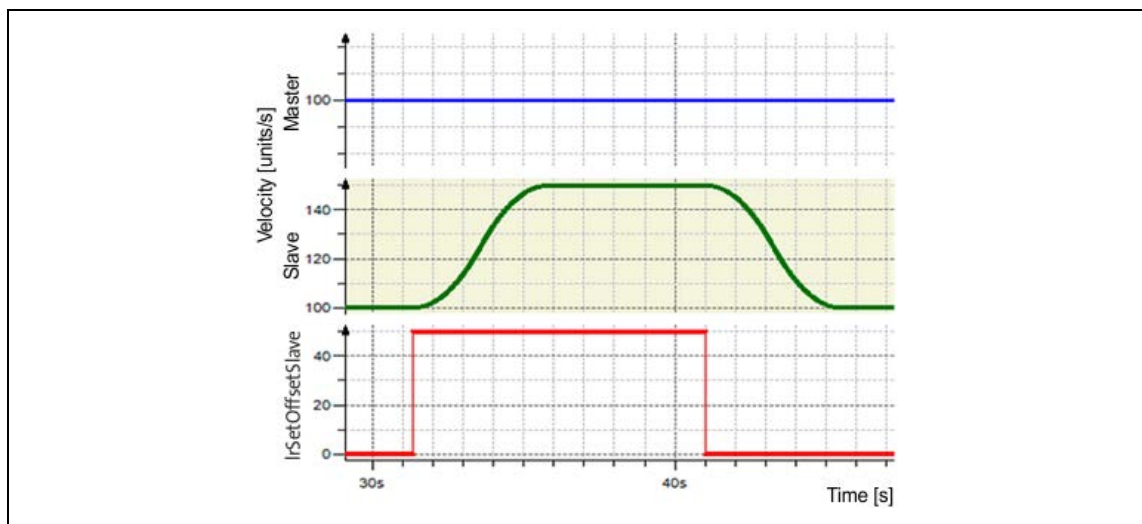
The velocity offsets transferred to the axis via a profile generator without position jumps. The offset is selected using the *lrSetOffsetSlave* input. The velocity offset is driven by means of S-rounding.

Parameters to be set

The parameters for the S-rounding are located in the [L TT1P_scPar_ElectricalShaftVel\[Base/State/High\]](#) (17) parameter structure.

```
lrOffsetAcc : LREAL := 100.0;
lrOffsetDec : LREAL := 100.0;
lrOffsetJerk : LREAL := 10000;
```

Example



[3-6] Velocity offset (*lrSetOffsetSlave* = 50) by means of S-rounding (*lrOffsetJerk* = 10)

3.12 Synchronism with basic velocity

Execution

The basic velocity is active as soon as a non-zero value is set in the *lrSetGroundVel* input. Immediately after the function block has been activated, the drive travels to the basic velocity by means of S-rounding and then changes to the "GROUNDVEL" state.

Based on this state, the slave axis velocity can be synchronised to the master velocity of the master axis via the clutch function – as in case of [Synchronism with clutch-in/declutch mechanism](#) (□ 29). Clutching-in starts at any position when *xSyncVel* = TRUE. When declutching by means of *xSyncVel* = FALSE, the drive travels back to basic velocity with the *lrSyncOutAcc* deceleration.

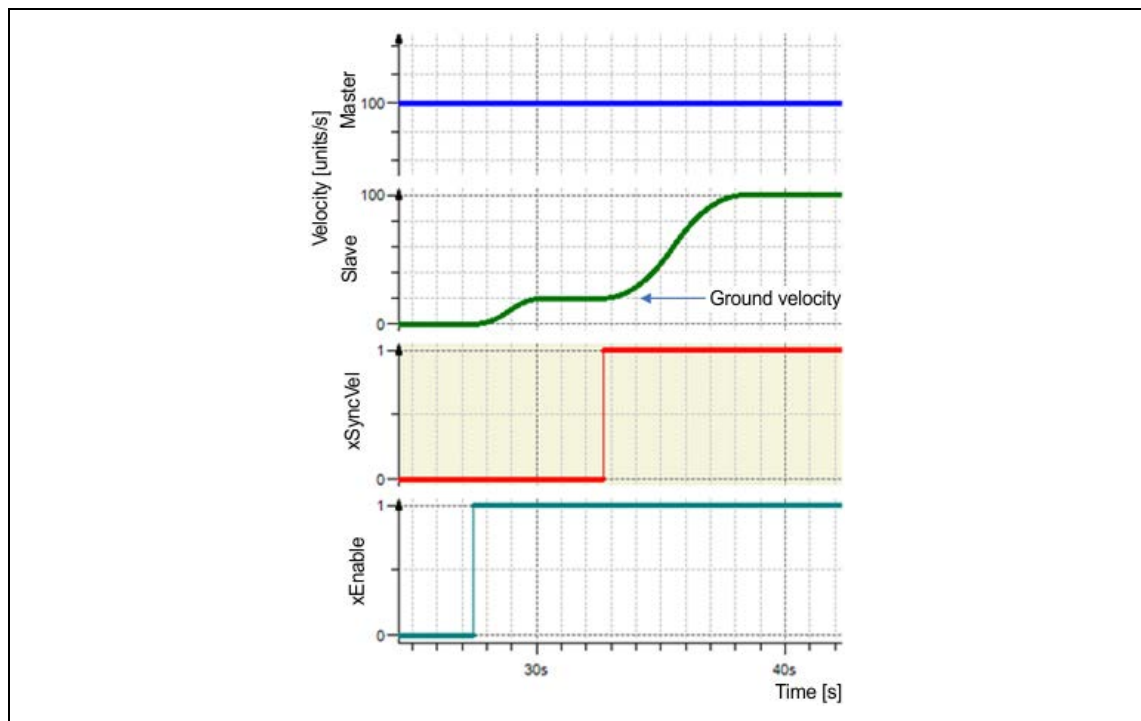
Parameters to be set

The parameters for the S-rounding and the clutch function are located in the [L_TT1P_scPar_ElectricalShaftVel\[Base/State/High\]](#) (□ 17) parameter structure.

```
// Parameters for S-rounding
lrOffsetAcc : LREAL := 100.0;
lrOffsetDec : LREAL := 100.0;
lrOffsetJerk : LREAL := 10000;

// Parameters for the clutch function
lrSyncOutAcc : LREAL := 10.0;
lrSyncInAcc : LREAL := 10.0;
lrSyncJerk : LREAL := 10000;
```

Example



[3-7] Clutch-in process (*xSyncVel* = TRUE) with basic velocity (*lrSetGroundVel* = 20)

3.13 CPU utilisation (example Controller 3231 C)

The following table shows the CPU utilisation in microseconds using the example of the 3231 C controller (ATOM™ processor, 1.6 GHz).

Versions	Wiring of the technology module	CPU utilisation	
		Average	Maximum peak
Base	xEnable := TRUE; xRegulatorOn := TRUE; xSyncVel := TRUE;	40 µs	72 µs
State	xEnable := TRUE; xRegulatorOn := TRUE; xSyncVel := TRUE;	50 µs	83 µs
High	xEnable := TRUE; xRegulatorOn := TRUE; xSyncVel := TRUE;	60 µs	91 µs

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Your opinion is important to us

These instructions were created to the best of our knowledge and belief to give you the best possible support for handling our product.

Perhaps we have not succeeded in achieving this objective in every respect. If you have suggestions for improvement, please e-mail us to:

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Thank you very much for your support.

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