FAST Application Software

Technology module

Virtual Master ______________________________

Reference Manual EN

13531752

Lenze

Contents

1 About this documentation

This documentation ...

- contains detailed information on the functionalities of the "Virtual Master" 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.

1.1 Document history

Version			Description
4.2	05/2017	TD17	• Content structure has been changed. • General revisions
4.1	04/2016	TD17	General revisions
4.0	10/2015	TD17	• Corrections and additions • Content structure has been changed.
3.0	05/2015	TD17	• General revisions • New: eSyncMode parameter (see parameter structure L_TT1P_scPar_VirtualMaster[Base/State/High] (🕮 16)) • New: Time-based position synchronism (🕮 28)
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

1.2 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	*italics*	By setting *bEnable* 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.

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.

Possible consequences

Damage or destruction of machine parts

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 "Virtual Master"

3.1 Overview of the functions

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

Functionality	Versions		
	Base	State	High
Stop function (🕮 20)	●	●	●
Manual jog (jogging) (🕮 21)	●	●	●
Single cycle operation (🕮 22)	●	●	●
Continuous driving operation (🕮 23)	●	●	●
Loading of starting position (🕮 24)	●	●	●
Speed synchronism (🕮 25)		●	
Path-based position synchronism (🕮 26)			●
Time-based position synchronism (🕮 28)			●

»PLC Designer« Online help

Here you'll find some detailed information with regard to the **L_MC1P_AxisBasicControl** function block and the **Holding function**.

3.2 Important notes on how to operate the technology module

Setting of the operating mode

The operating mode for the cross cutter axis has to be set to "cyclically synchronous position" (csp) because the axis is led via the master position value.

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↗TRUE edge.

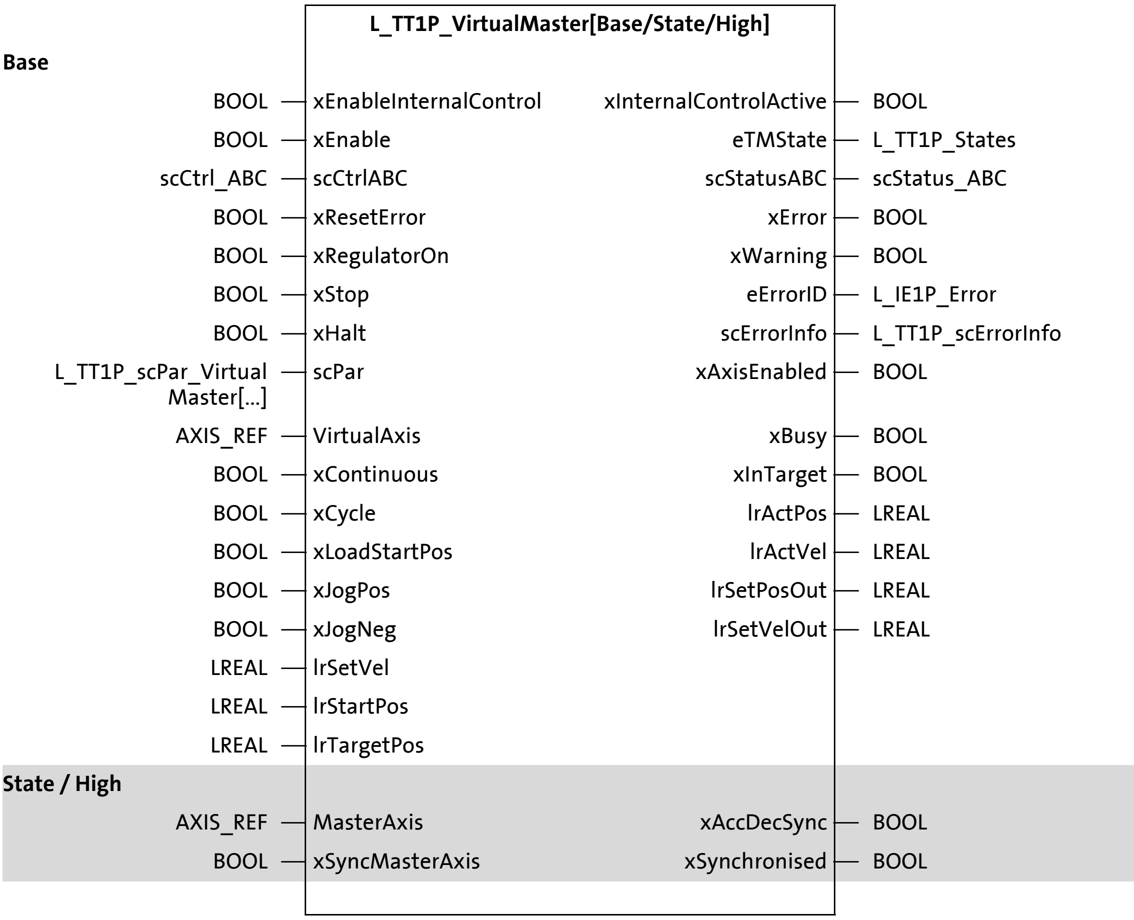
In this way it is prevented that the drive starts in an uncontrolled manner after controller enable.

Example Manual jog (jogging) (📖 21)**:**

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↗TRUE
     ==> "JOGPOS" state

3.3 Function block L_TT1P_VirtualMaster[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
VirtualAxis / AXIS_REF	Reference to the virtual master 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 technology module remains in the "Stop" state as long as xStop is set to TRUE (or xHalt = TRUE). • 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 L_TT1P_scPar_Virtual Master[...]	The parameter structure contains the parameters of the technology module. The data type depends on the version used (Base/State/High).		●	●	●
xContinuous BOOL	TRUE	Execute continuous driving operation. (Abort of the function via the inputs xStop and xHalt or by switching on the real master axis.)	●	●	●
xCycle BOOL	TRUE	Execute single-cycle operation. (Abort of the function via the inputs xStop and xHalt or by switching on the real master axis.)	●	●	●
xLoadStartPos BOOL	TRUE	Load starting position (lrStartPos input). • This function can also be executed when the axis is inhibited or when xStop/xHalt = TRUE. • This function <u>cannot</u> be executed during position synchronism.	●	●	●
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

lrSetVel
LREAL
	Velocity
	New velocity values are transferred to one of the control inputs any time and without a renewed edge change.
	The direction of rotation is specified via the eSetDirection parameter.
	• Unit: units/s
	• Initial value: 10
	• Valid values:
	  • Positive values for single cycle operation (xCycle input = TRUE)
	  • Negative and positive values for continuous driving operation (xContinuous input = TRUE)
		●	●	●

lrStartPos LREAL	Starting position to be loaded Is transferred when the input xLoadStartPos = TRUE. • Unit: units	●	●	●
lrTargetPos LREAL	Target position • Unit: units	●	●	●
MasterAxis AXIS_REF	Reference to the real master axis		●	●
xSyncMasterAxis BOOL	Synchronisation of the real master axis (master axis) to the virtual master axis The real master axis is instanced at the MasterAxis input. TRUE: **State version:** The virtual master axis is coupled to the real master axis with synchronous velocity. The lrMasterAccDec parameter serves to specify the acceleration/deceleration (in units/s^2) for clutching-in and declutching purposes. **High version:** The virtual master axis is coupled to the real master axis with synchronous velocity and position. The lrMasterSyncInDist parameter serves to specify the relative clutch-in distance (in units) with regard to the virtual master position. TRUE↘FALSE: The virtual master axis is decoupled from the real master axis and brought into the target position via the parameters lrSetVel, lrAcc, lrDec (lrTargetPos input).		●	●

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 for the "Base" and "State" versions (🕮 18) ▸ State machine for the "High" version (🕮 19)		●	●	●
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		●	●	●
xAxisEnabled BOOL	TRUE	The axis is enabled.	●	●	●
xBusy BOOL	TRUE	The request/action is currently being executed.	●	●	●
xInTarget BOOL	TRUE	The axis has reached the target position (lrTargetPos input) and is at standstill.	●	●	●
lrActPos LREAL	Current actual position • Unit: units		●	●	●
lrActVel LREAL	Current actual velocity • Unit: units/s		●	●	●
lrSetPosOut LREAL	Setpoint position • Unit: units		●	●	●
lrSetVelOut LREAL	Setpoint speed • Unit: units/s		●	●	●
xAccDecSync BOOL	TRUE	The synchronisation function is active. The virtual master axis is coupled to the real master axis.		●	●
xSynchronised BOOL	TRUE	The virtual master axis is synchronised to the real master axis. **State version:** The velocity of the virtual master axis is synchronised to the real master axis. **High version:** The velocity and position of the virtual master axis is synchronised to the real master axis.		●	●

3.3.4 Parameters

L_TT1P_scPar_VirtualMaster[Base/State/High]

The **L_TT1P_scPar_VirtualMaster[Base/State/High]** structure contains the parameters of the technology module.

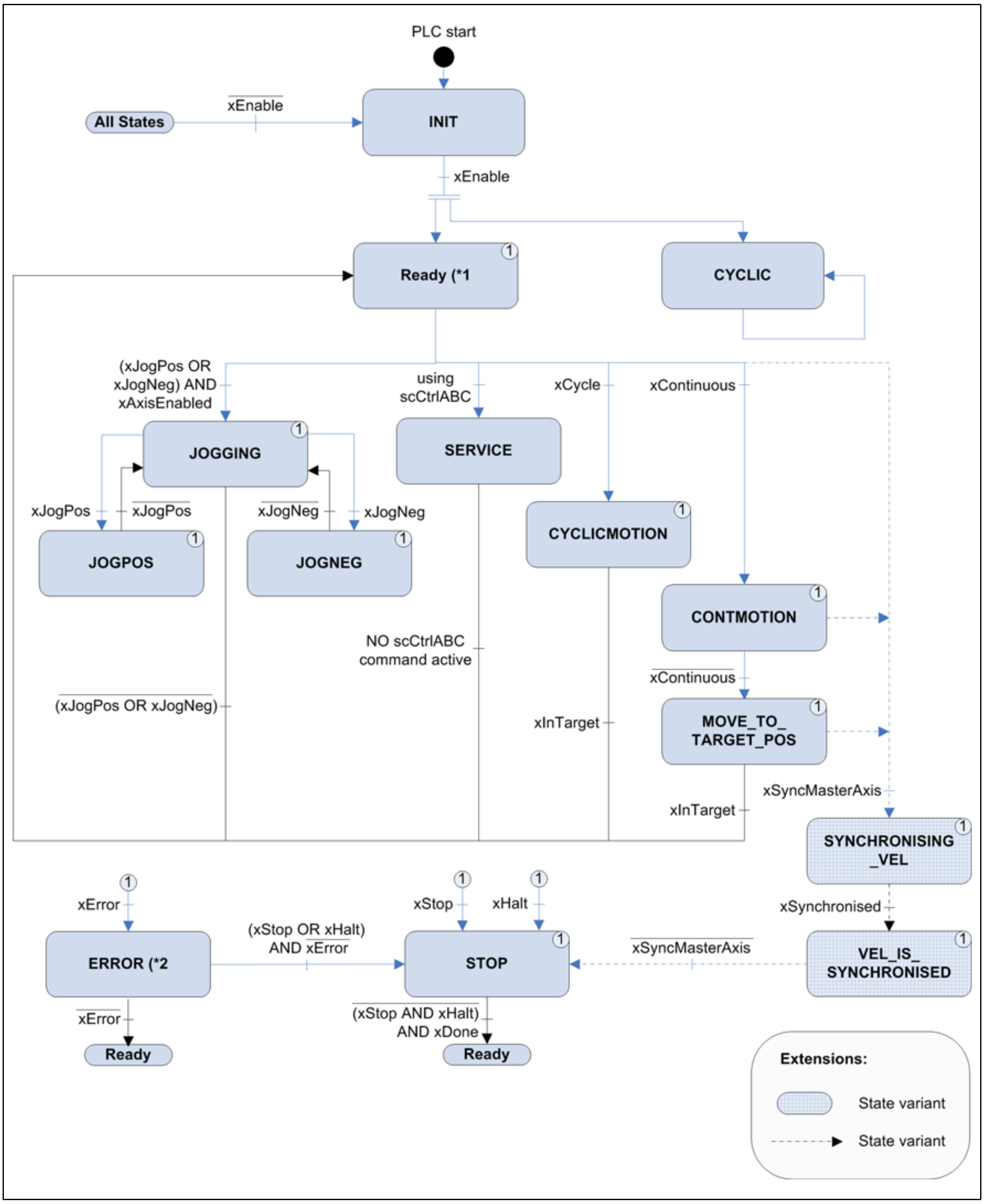
Note!

Changes of the parameter values will only be considered when the functions are executed again.

Designator / Data type	Description	Available in version		
		Base	State	High
lrStopDec 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	●	●	●
lrStopJerk 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	●	●	●
lrHaltDec 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.	●	●	●
lrJerk LREAL	Jerk for compensating a clutch or holding function • Unit: units/s^3 • Initial value: 100000	●	●	●
lrJogJerk LREAL	Jerk for manual jog • Unit: units/s^3 • Initial value: 10000	●	●	●
lrJogVel LREAL	Maximum speed to be used for manual jog. • Unit: units/s • Initial value: 10	●	●	●
lrJogAcc LREAL	Acceleration for manual jog Specification of the maximum speed variation which is to be used for acceleration. • Unit: units/s^2 • Initial value: 100	●	●	●
lrJogDec 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	●	●	●
lrAcc LREAL	Acceleration Specification of the maximum speed variation which is to be used for acceleration. • Unit: units/s^2 • Initial value: 100	●	●	●

<table>
<tr><th rowspan="2">Designator
Data type</th><th rowspan="2" colspan="2">Description</th><th colspan="3">Available in version</th></tr>
<tr><th>Base</th><th>State</th><th>High</th></tr>
<tr><td>lrDec
LREAL</td><td colspan="2">Deceleration
Specification of the maximum speed variation which is to be used for deceleration to standstill.
• Unit: units/s²
• Initial value: 100</td><td>●</td><td>●</td><td>●</td></tr>
<tr><td rowspan="4">eDirection
MC_DIRECTION</td><td colspan="2">Traversing direction
• Initial value: 1 (positive direction)</td><td rowspan="4">●</td><td rowspan="4">●</td><td rowspan="4">●</td></tr>
<tr><td>0</td><td>Retain current direction.
Only adjustable for:
• Continuous driving operation (xContinuous input = TRUE)
• Synchronisation with the real master axis (xSyncMasterAxis = TRUE)</td></tr>
<tr><td>1</td><td>Positive direction</td></tr>
<tr><td>2</td><td>Negative direction</td></tr>
<tr><td>lrMasterAccDec
LREAL</td><td colspan="2">Acceleration/deceleration for clutching-in/declutching the synchronisation (xSyncMasterAxis input = TRUE)
• Unit: units/s²
• Initial value: 100</td><td></td><td>●</td><td></td></tr>
<tr><td rowspan="3">eSyncMode
L_TT1P_SyncModeVirtualMaster</td><td colspan="2">Mode for the clutch-in process
• Initial value: 5 (Ramp_Dist)</td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3">●</td></tr>
<tr><td>3</td><td>ramp_time:
Time-based clutch-in within a time slot (time-based position synchronism)</td></tr>
<tr><td>5</td><td>Ramp_Dist:
Path-based clutch-in to the cam (path-based position synchronism)</td></tr>
<tr><td>lrMasterSyncInDist
LREAL</td><td colspan="2">Relative clutch-in/declutch distance with regard to the virtual master position for synchronisation (xSyncMasterAxis input = TRUE)
• Unit: units
• Initial value: 90</td><td></td><td></td><td>●</td></tr>
<tr><td>lrSyncInTime
LREAL</td><td colspan="2">Duration of the clutch-in process in the time-based coupling mode (parameter eSyncMode = 3)
• Unit: s
• Initial value: 5</td><td></td><td></td><td>●</td></tr>
</table>

3.4 State machine for the "Base" and "State" versions

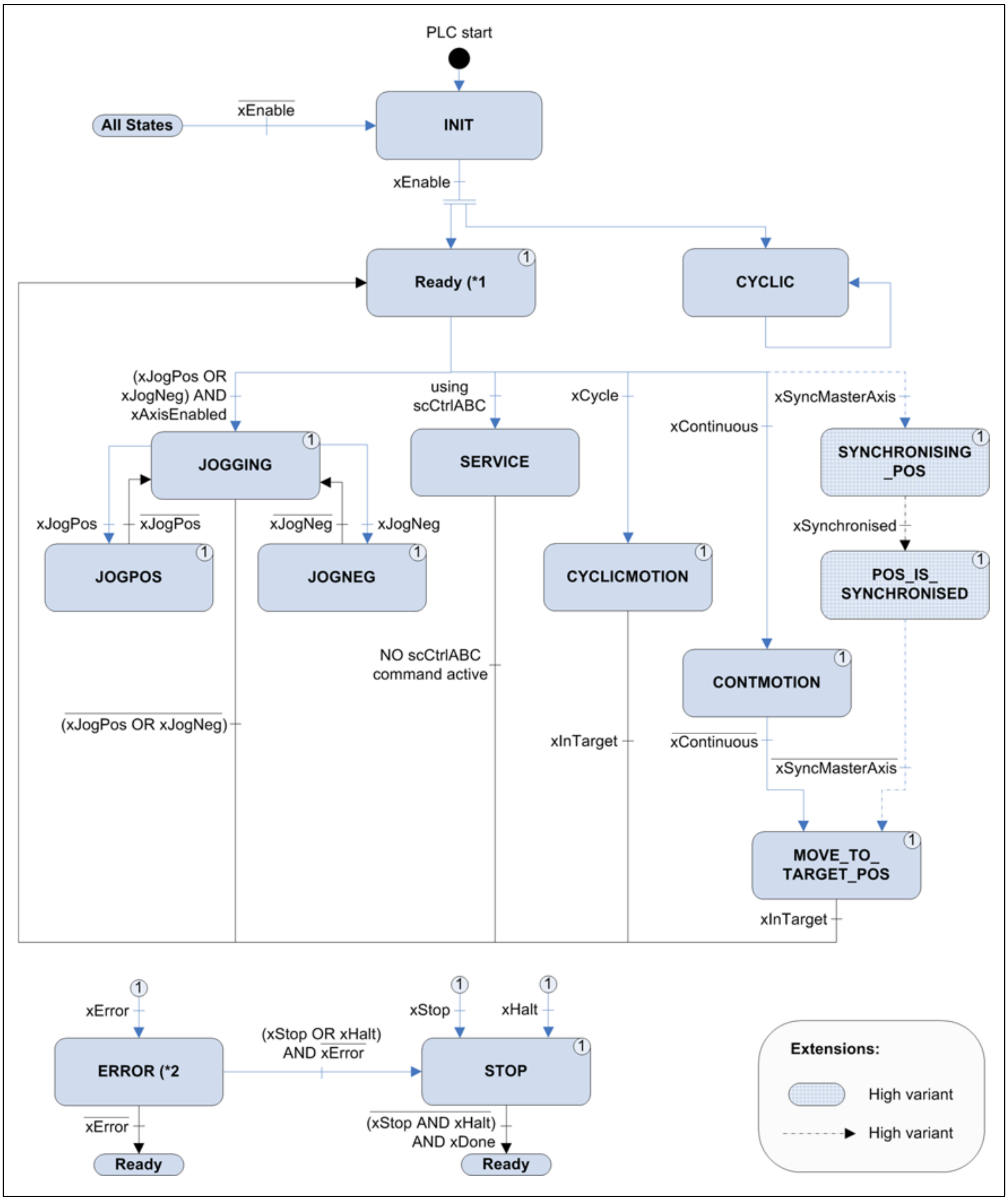


[3-1] State machine for the "Base" and "State" versions of the technology module

(*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.

3.5 State machine for the "High" version



[3-2] State machine for the "High" version of the technology module

(*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.

3.6 Stop function

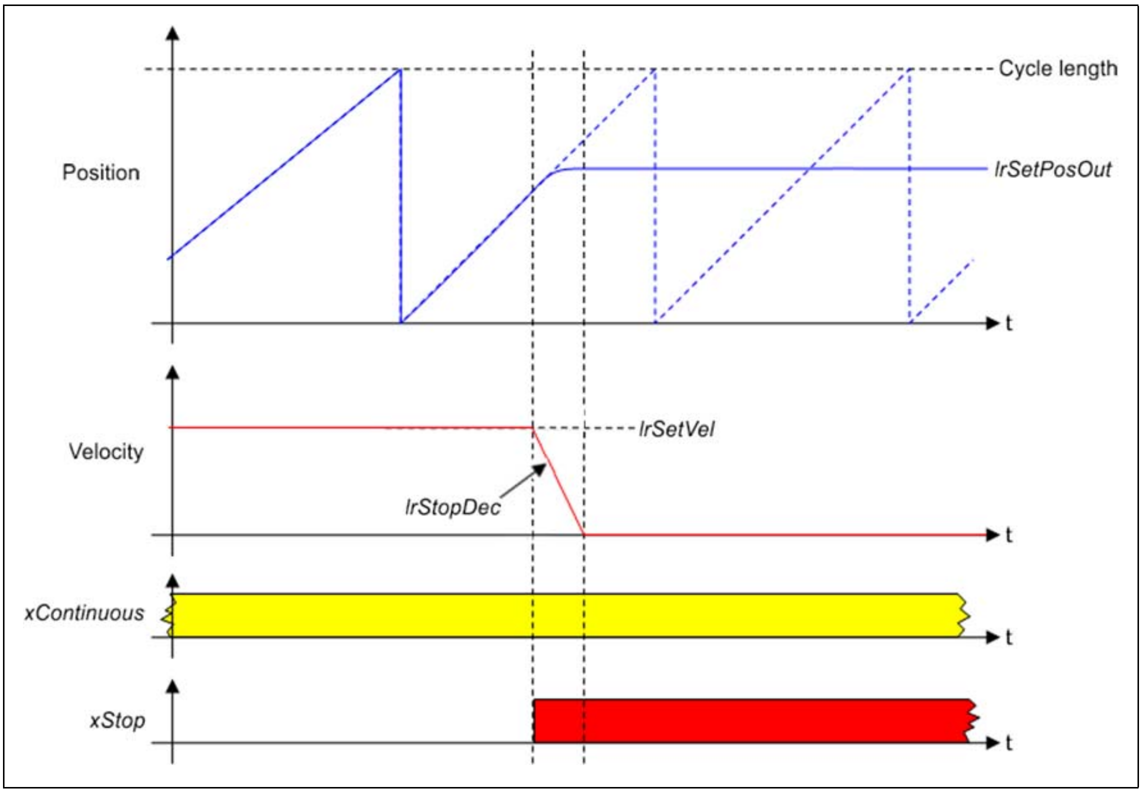
The virtual master axis is braked to standstill by setting the input *xStop* = TRUE using the *lrStopDec* parameter.

This function has the second highest priority (highest priority has "Loading of starting position (📖 24)").

As long as *xStop* = TRUE, the virtual axis remains at standstill.

The single cycle and continuous driving operation modes have to be restarted after being stopped.

The motion of the virtual master axis is also stopped during synchronisation (input *xSyncMasterAxis* = TRUE). As soon as *xStop* = FALSE, the synchronisation is made with the real master axis.



[3-3] Signal characteristic for the stop function

Parameters to be set

The parameters for the stop function are located in the L_TT1P_scPar_VirtualMaster[Base/State/High] (📖 16) parameter structure.

```
lrStopDec : LREAL := 10000;   // Deceleration [units/s^2]
lrStopJerk : LREAL := 100000;  // Jerk [units/s^3]
```

3.7 Manual jog (jogging)

When the *xJogPos* input = TRUE, the virtual master axis is traversed in positive direction and when the *xJogNeg* input = TRUE, the axis is traversed in negative direction. The axis is traversed 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 changes to the "Ready" state again.

Parameters to be set

The parameters for the manual jog are located in the L_TT1P_scPar_VirtualMaster[Base/State/High] (📖 16) 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 setting the inputs *xJogPos* = TRUE or *xJogNeg* = TRUE.

3.8 Single cycle operation

The single cycle operation is started when the *xCycle* input = TRUE.

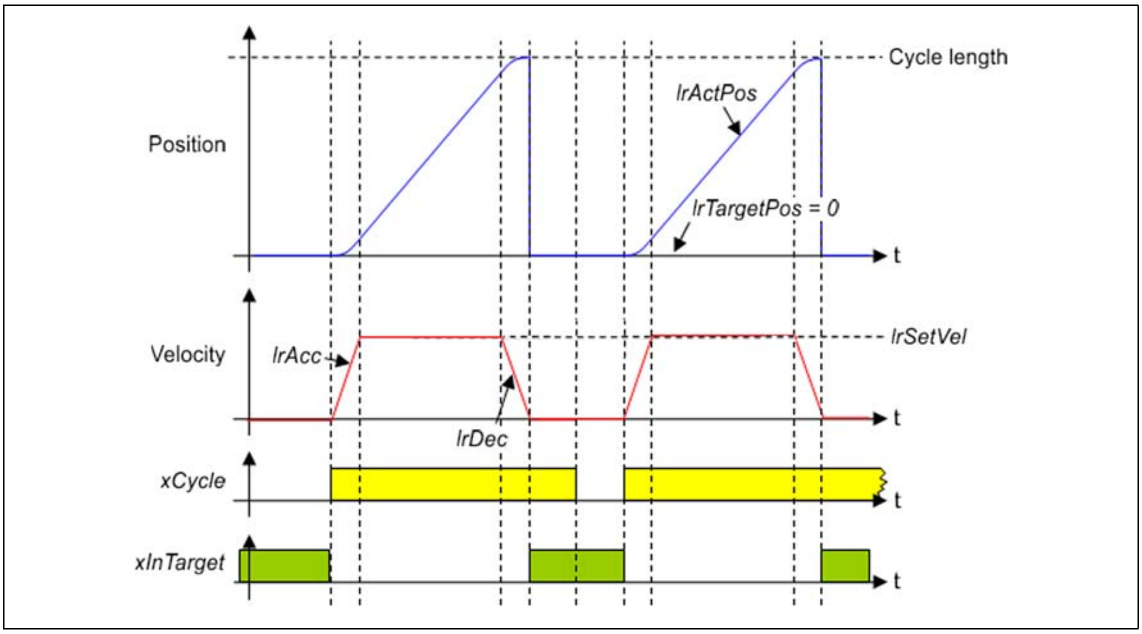
The cycle starts at the current *lrActPos* position of the virtual master axis and ends at the *lrTargetPos* target position.

The direction of rotation is defined using the *eDirection* parameter:

- Value '1' = positive direction (initial value)
- Value '2' = negative direction

The travelling speed is defined at the *lrSetVel* input.

If the single cycle operation is interrupted, e.g. by a stop or clutch-in to the real master axis, the *xCycle* has to be reset to TRUE.



[3-4] Signal characteristic for the single cycle operation

Parameters to be set

The parameters for the single cycle operation are located in the L_TT1P_scPar_VirtualMaster[Base/State/High] (📖 16) parameter structure.

```
eDirection : MC_DIRECTION := 1;  // 1 = Positive direction
lrAcc : LREAL := 100;            // Acceleration [units/s^2]
lrDec : LREAL := 100;            // Deceleration [units/s^2]
lrJerk : LREAL := 100000;        // Jerk [units/s^3]
```

3.9 Continuous driving operation

The continuous driving operation is started when the *xContinuous* input = TRUE and remains active until *xContinuous* = FALSE.

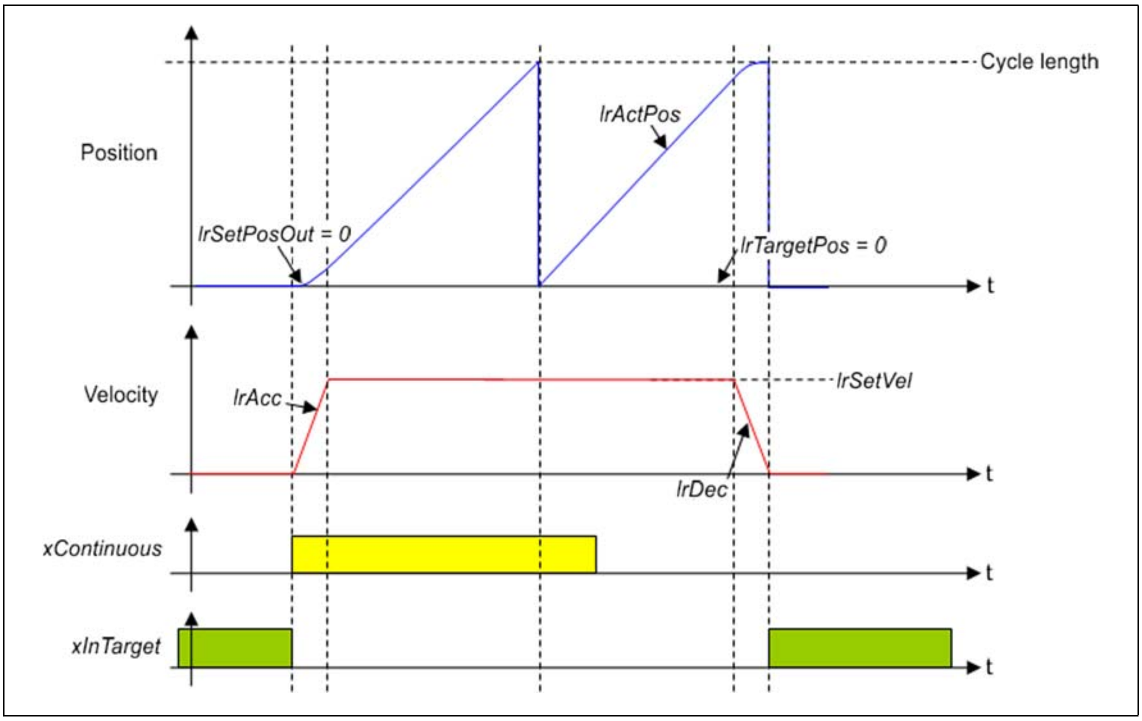
The cycle starts at the *lrSetPosOut* setpoint position of the virtual master axis and ends at the *lrTargetPos* target position.

The direction of rotation is defined using the *eDirection* parameter:

- Value '1' = positive direction (initial value)
- Value '2' = negative direction

The travelling speed is defined at the *lrSetVel* input.

If the single cycle operation is interrupted, e.g. by a stop or clutch-in to the real master axis, the *xContinuous* has to be reset to TRUE.



[3-5] Signal characteristic for continuous driving operation

Parameters to be set

The parameters for continuous driving operation are located in the L_TT1P_scPar_VirtualMaster[Base/State/High] (16) parameter structure.

```
eDirection : MC_DIRECTION := 1;  // 1 = Positive direction
lrAcc : LREAL := 100;            // Acceleration [units/s^2]
lrDec : LREAL := 100;            // Deceleration [units/s^2]
lrJerk : LREAL := 100000;        // Jerk [units/s^3]
```

3.10 Loading of starting position

Stop!

Damage to machine parts

Machine parts can be damaged by a "strike" at the drive shaft(s).

Possible consequences

Damage or destruction of machine parts

Protective measures

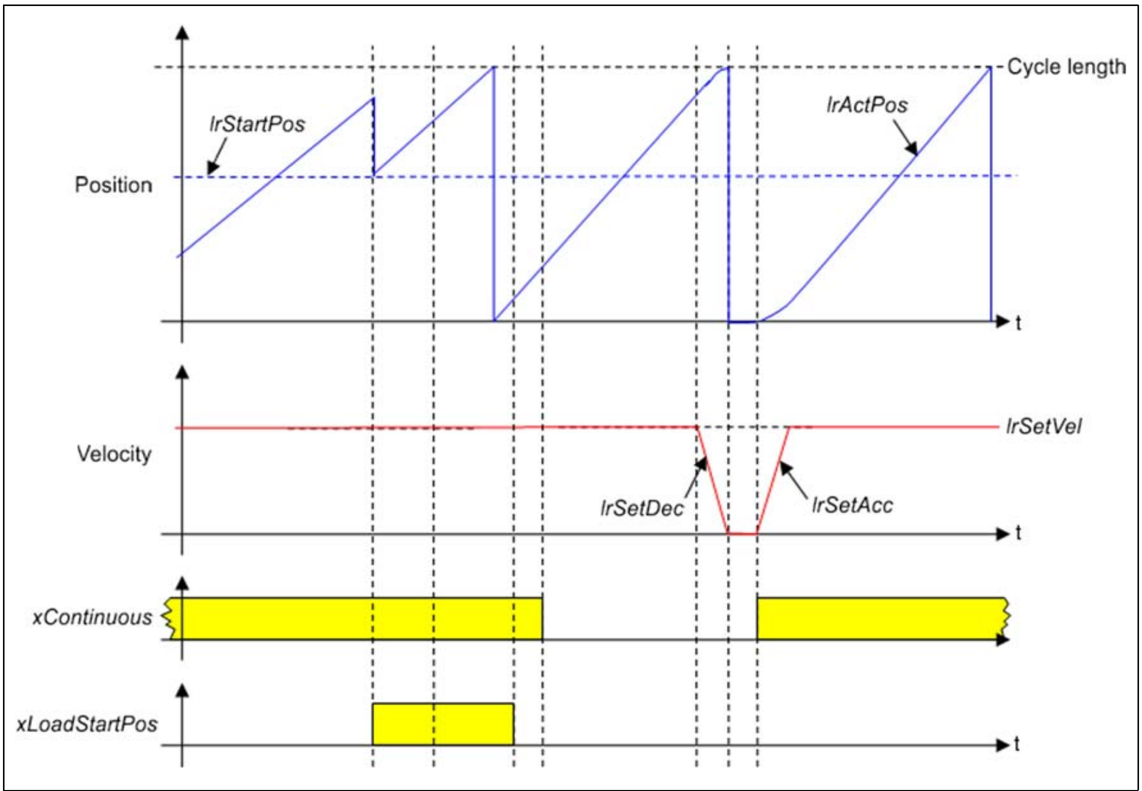
Only activate the "Load starting position" function if ...
- the master axis is at standstill or
- all following axes are decoupled.

The "Load starting position" function supports the adjustment of the position of the virtual master with the position of the real master axis.

Example: The real master axis stands at 60°. When the "Load starting position" function is loaded, the starting position of the virtual master is set to 60°.

When the *xLoadStartPos* input is set to TRUE, the set *lrStartPos* starting position is directly transferred ("without smoothing") as *lrSetPosOut* setpoint position.

The "Load starting position" cannot be executed in the states ERROR, SYNCHRONISING_POS and POS_IS_SYNCHRONISED.



[3-6] Signal characteristic for the "Load starting position" function

3.11 Speed synchronism

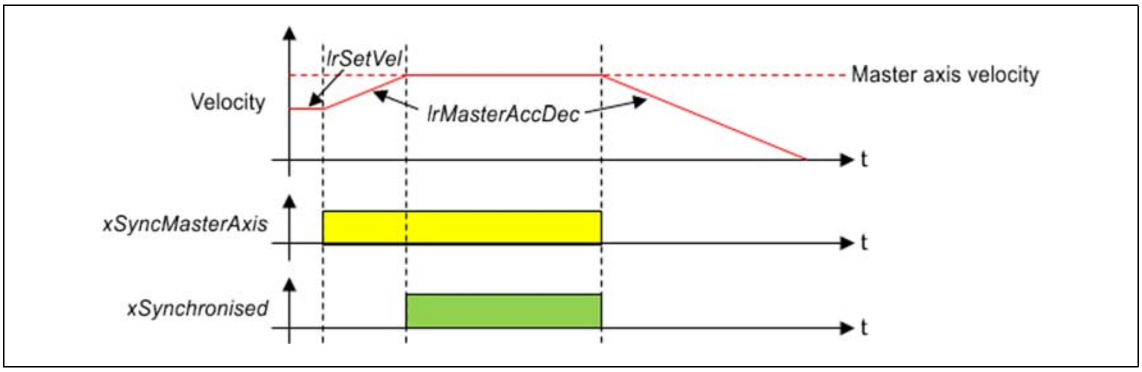
When the *xSyncMasterAxis* input = TRUE, the virtual master axis is synchronised to the real master axis. The velocity of the real master axis is clutched in at the *MasterAxis* input (speed synchronism). This can also happen during operation when the real axis rotates.

With *xSyncMasterAxis* = FALSE, speed synchronism is cancelled and the virtual master axis is braked to a standstill with the deceleration defined in the *lrMasterAccDec* parameter. The target position results from the deceleration.

The Stop function (📖 20) and the Loading of starting position (📖 24) function can also be executed during the synchronism.

Up to »PLC Designer« version 3.5.1.10:

After a quick stop (QSP), the velocity synchronism must not be executed again. The virtual axis is immediately synchronised to the real axis again.



[3-7] Signal characteristic when clutching-in/declutching in the State version

Parameters to be set

The *lrMasterAccDec* parameter for the clutch function is located in the L_TT1P_scPar_VirtualMaster[Base/State/High] (📖 16) parameter structure.

```
lrMasterAccDec : LREAL := 100;
```

3.12 Path-based position synchronism

With the *eSyncMode* parameter = 5, path-based position synchronism specified.

Via the *eDirection* parameter, the clutch-in direction relating to the direction of rotation of the real master axis is set:

- *eDirection = 0*: retain current direction of rotation.
  Only adjustable for:
  - Continuous driving operation (xContinuous input = TRUE)
  - Synchronisation with the real master axis (xSyncMasterAxis = TRUE)
- *eDirection = 1*: positive direction of rotation (initial value)
- *eDirection = 2*: negative direction of rotation

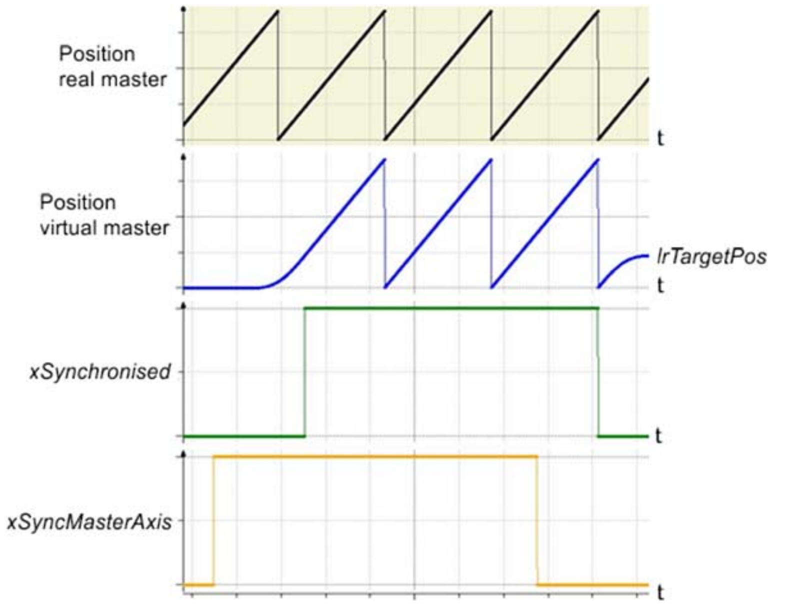
When the *xSyncMasterAxis* input = TRUE, the virtual master axis is synchronised to the real master axis. The position of the real axis is clutched in to the virtual axis via the distance defined in the *lrMasterSyncInDist* parameter (position synchronism).

Position synchronism is only possible in the "READY" state.

During operation, this means when the real axis rotates, a position synchronism is not possible.

When *xSyncMasterAxis* = FALSE, the position synchronism is completed. The virtual master axis is brought into the target position via the parameter *lrSetVel*, *lrAcc*, *lrDec* (*lrTargetPos* input).

The Stop function (🕮 20) and the Loading of starting position (🕮 24) function can also be executed during the synchronism.



[3-8] Signal characteristic when clutching-in/declutching in the High version

Parameters to be set

The parameters for the clutch function are located in the L_TT1P_scPar_VirtualMaster[Base/State/High] (📖 16) parameter structure.

```
eSyncMode : L_TT1P_SyncModeVirtualMaster := 5;
            // 3 = Ramp_Time
            // 5 = Ramp_Dist
eDirection : MC_DIRECTION := 1;
             // 0 = Current direction
             // 1 = Positive direction
             // 2 = Negative direction
lrMasterSyncInDist : LREAL := 90.0;  // [units]
lrAcc : LREAL := 100;  // Acceleration [units/s^2]
lrDec : LREAL := 100;            // Deceleration [units/s^2]
```

3.13 Time-based position synchronism

With the *eSyncMode* parameter = 3, time-based position synchronism specified.

Via the *eDirection* parameter, the clutch-in direction relating to the direction of rotation of the real master axis is set:

- *eDirection = 0*: retain current direction of rotation.
  Only adjustable for:
  - Continuous driving operation (xContinuous input = TRUE)
  - Synchronisation with the real master axis (xSyncMasterAxis = TRUE)
- *eDirection = 1*: positive direction of rotation (initial value)
- *eDirection = 2*: negative direction of rotation

The virtual axis is clutched in to the resulting position of the real master axis from its current position within a time defined (*lrSyncInTime* parameter) via a 5th degree polynomial. The movement is executed within the cycle of the Modulo axes.

This coupling mode is irrespective of the movement of the real master axis. Synchronisation of the virtual master axis with the position is also effected if the real master axis is at a standstill.

Position synchronism is only possible in the "READY" state.

Parameters to be set

The parameters for the clutch function are located in the L_TT1P_scPar_VirtualMaster[Base/State/High] (📖 16) parameter structure.

```
eSyncMode : L_TT1P_SyncModeVirtualMaster := 5;
            // 3 = Ramp_Time
            // 5 = Ramp_Dist
eDirection : MC_DIRECTION := 1;
             // 0 = Current direction
             // 1 = Positive direction
             // 2 = Negative direction
lrSyncInTime : LREAL := 5;  // [seconds]
```

3.14 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	Interconnection of the technology module	CPU utilisation	
		Average	Maximum peak

Base	xEnable := TRUE;
	xRegulatorOn := TRUE;
	xSyncVel := TRUE;
		50 µs	115 µs

State	xEnable := TRUE;
	xRegulatorOn := TRUE;
	xSyncVel := TRUE;
		50 µs	115 µs

High	xEnable := TRUE;
	xRegulatorOn := TRUE;
	xSyncVel := TRUE;
		55 µs	118 µs

FEEDBACK

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:

feedback-docu@lenze.com

Thank you very much for your support.

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