



TwinCAT

The Windows Control and Automation Technology

NC PTP

Numerical Control Point To Point



NC-PTP

Part I General

- Overview
- Axis types
- Functional principle
- Referencing
- Motion Control Function blocks

Teil II Practical Part:

- Setting up NC axes in the System Manager
- Starting NC axes from the PLC



Software NC PTP

TwinCAT NC Point-to-Point (PTP) is an axis positioning software with integrated PLC, NC interface, operating program for axes setup and I/O connection of the axes through the fieldbus.

Up to 255 axes can be moved at the same time.

TwinCAT NC PTP supports axis drive by switched motors, stepper motors, frequency controlled and servo controlled motors.

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Software NC PTP



TwinCAT NC PTP

Programming

Performed using function blocks for TwinCAT PLC according to IEC61131-3, convenient axis commissioning menus

Debugging

Online monitoring of all axis state variables such as actual/set value, enable, controller values, online axis tuning, forcing axis variables

Runtime system

NC Point-to-Point (NC PTP) including TwinCAT PLC

Number of axes

Up to 255 in up to 255 channels

Axis types

Electrical and hydraulic servo drives, frequency converter drives, stepper motor drives, switched drives (fast/crawl axes)

Cycle time

Min. 50 μ s, typ. 1 ms (freely adjustable)

Axis functions

Standard axis functions: start/stop/reset/reference
Velocity override, target override
Special functions: master-slave cascading, electronic gearboxes, online distance compensation of segments



Camshafts, Flying saw, FIFO

Camshafts

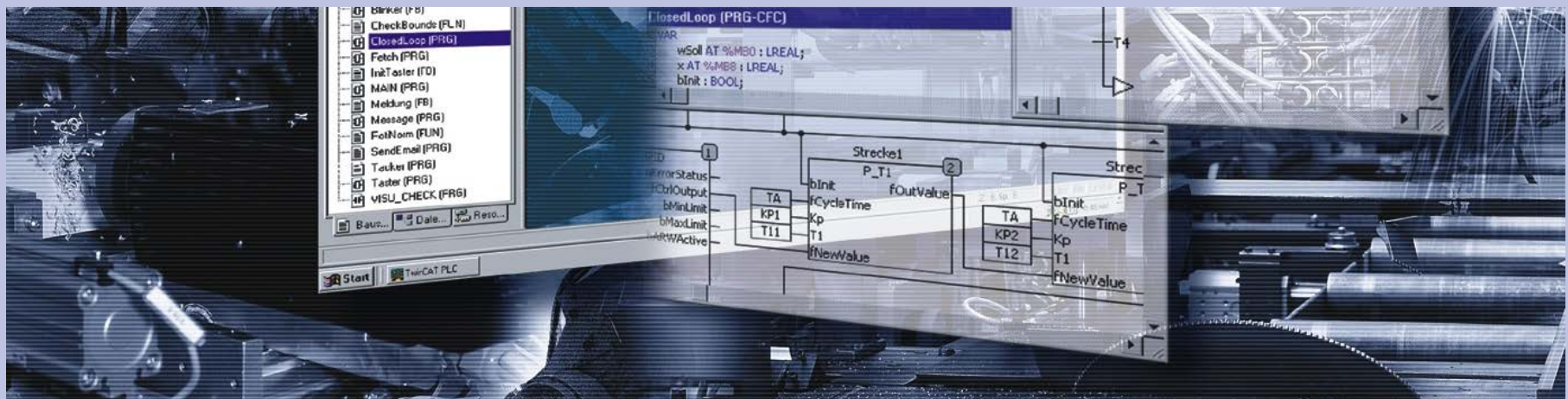
Software solution for electronic camshafts, obviating the need to use mechanical camshafts and special hardware assemblies. A table relates the position of the master axis (mainshaft) to the associated position to which the slave axis is driven.

Flying saw

The "flying saw" (diagonal slave) is a special kind of slave coupling. The slave axis is brought from standstill to a speed synchronous with the master.

FIFO

Instead of using internal generation of standard set values, an axis can also obey an externally calculated sequence of set values that can be supplemented as the movement of the axis proceeds (FIFO buffer).





Software NC I

TwinCAT NC Interpolation (NC I) is the NC system for linear or circular interpolated path movements of axis groups each involving two or three drives. TwinCAT NC I offers 2D and 3D interpolation (interpreter, set point generation, position controller), an integrated PLC with an NC-I interface and an I/O connection for axes via the field bus.



TwinCAT NC I

Programming

DIN 66025 programs for NC interpolation, access via function blocks for TwinCAT PLC according to IEC61131-3

Debugging

Online monitoring in the TwinCAT System Manager with the following displays: present set/actual positions, following errors of all axes, NC program line presently being executed/interpreted, channel status

Runtime System

NC PTP + NC interpolation, including TwinCAT PLC

Number of axes

3 axes per group, 1 group per channel, max. 255 channels

Axis types

Electrical servo-axes

Interpreter-functions

Subroutines and jumps, programmed loops, zero shifts, tool compensations, M and H functions,

Geometries

Straight lines and circular paths in 3D space, circular paths in all main planes, helices with base circles in all main planes

Axis functions

Online reconfiguration of axes in groups, path override, slave coupling to path axes



Axis types

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Manager
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from the PLC

Continuous axes

The axis responds to a continuously
changeable set value

The set value is generated by TwinCAT NC,

e.g. servo with +/- 10 V, Sercos drive,
frequency converter, linearised hydraulic axis,
stepper motor drive with amplifier



Axis types

speed axes

two-stage set speed value
ction of rotation:

ORWARDS/REVERSE

The set value is generated by TwinCAT NC,
e.g. frequency converter with fast/slow inputs, combination
interlock. Warning: Acquisition of actual value
(Encoder is necessary)



Axis types

stepper motor

Stepper motor which is connected to a controller and acts to pulses (A/B from the terminals)

► **motor turns quickly** | **Slow**

pulse sequence -> motor turns slowly

The set value (= pulse pattern) is generated by TwinCAT NC.



Axis types

Power motor, Hardware

Motor with 2A output terminals

Encoder is NOT required

Encoder value, since the pulses that are output are counted.

! The mechanical design and/or maximum rotary speed/torque should be examined to ensure that the motor will be able to "keep up", since an output terminal cannot provide an increased voltage at higher frequency



Axis types

Encoder axis,

consists of an encoder.

Virtual axes can be coupled to this axis with the set encoder value of the virtual encoder axis.
(Gear ration possible)

HAND WHEEL FUNCTION



Axis types

Actual speed value
Actual position is monitored.

Input:
Pre-control
Controller output

(acceleration pre-control also is optional)

Feedback:

Actual position value

At specific axis types e.g. SERCOS is also a direct output of the
Setposition in NC time possible.



Functional principle of the TwinCAT NC



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TwinCAT NC works with a **velocity pre control**.

The **Position controller** controls the observance of the set position („Motion“ and position control).

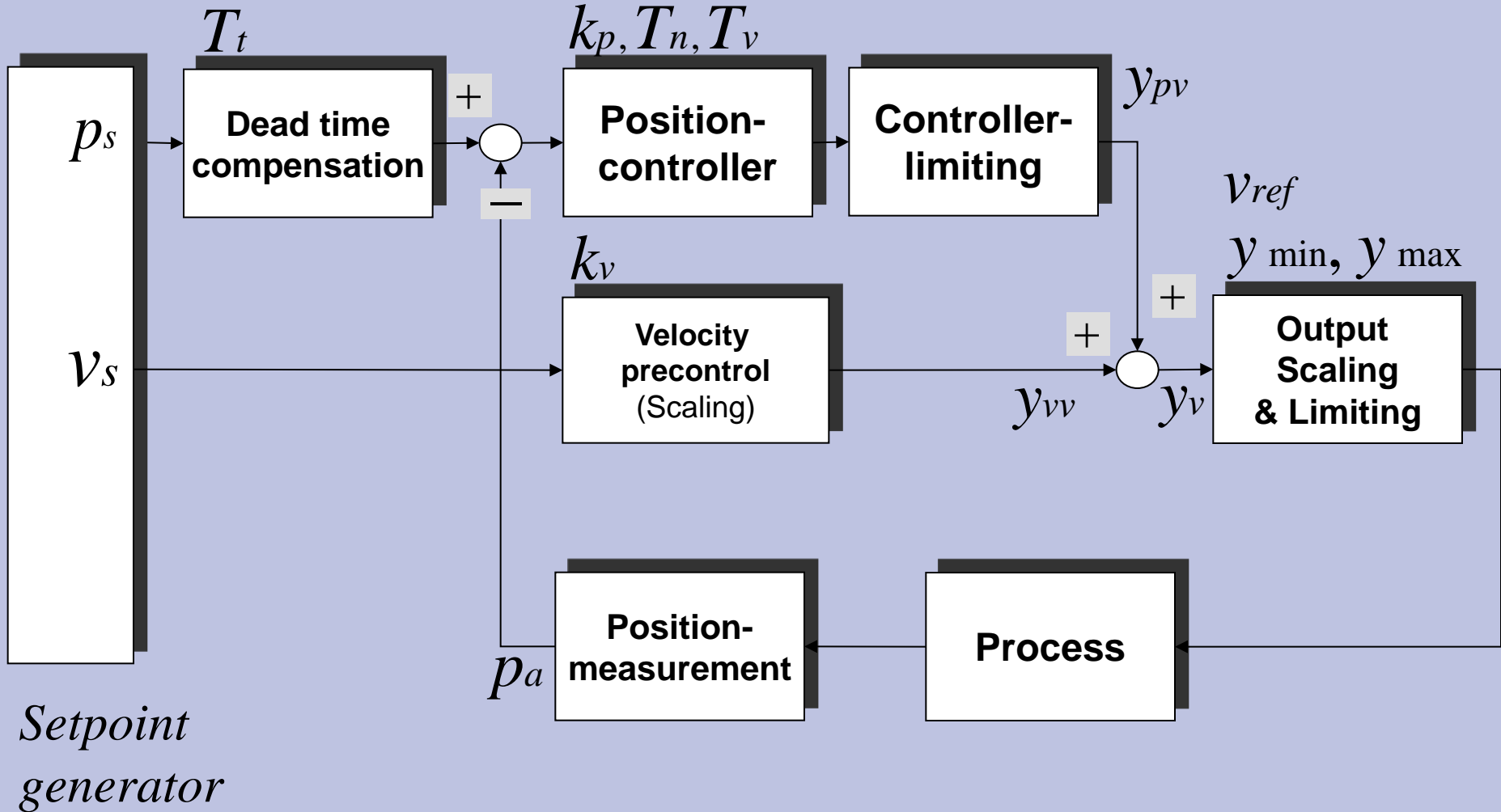
Further available options:

- Acceleration pre control
- Position control with two P constants
- direct output of the position. (Sercos Axes)

- High / low speed controller
- Stepper motor controller
- External Setpoint generation (ab TwinCAT 2.9)
- Linearisation of pre control for non linear axes (Hydraulic axes).

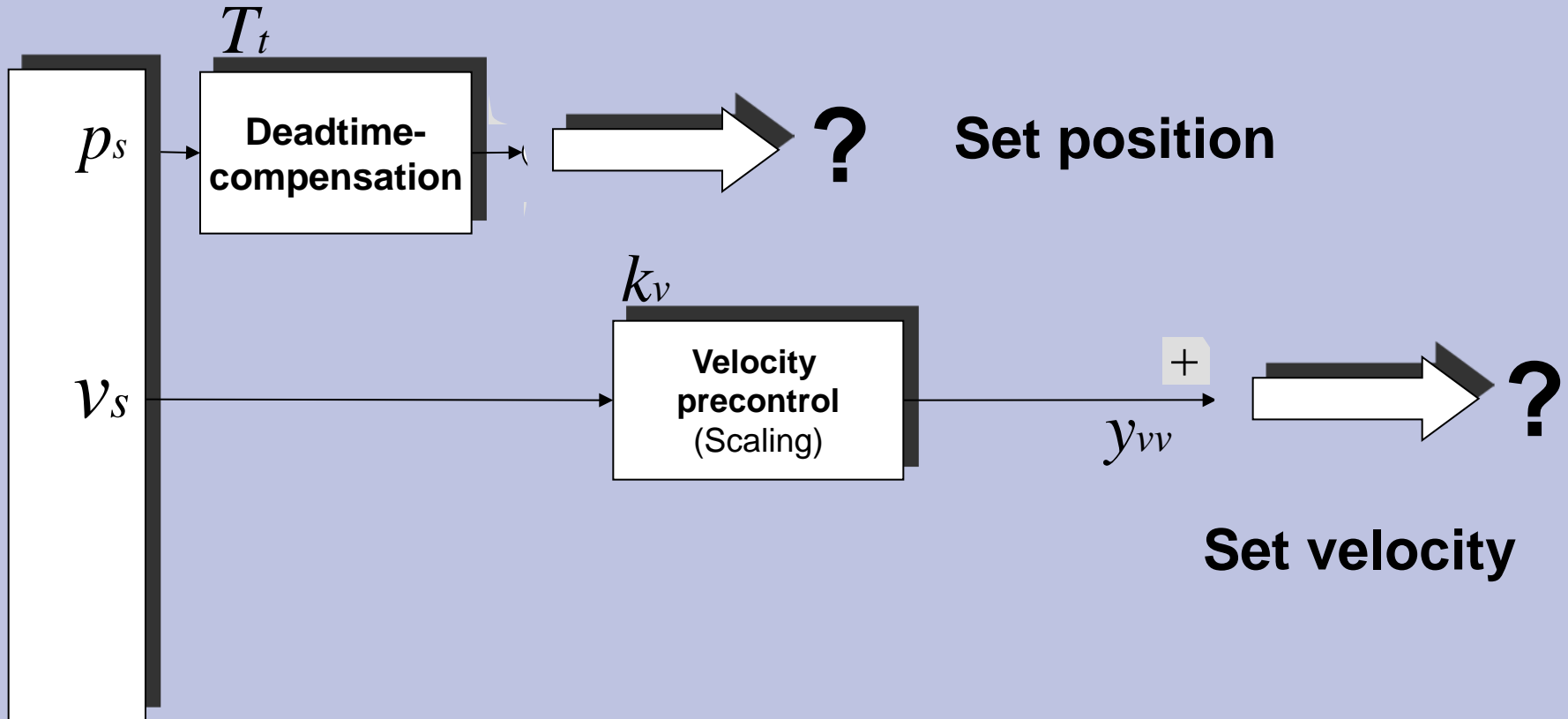


Functional principle of the TwinCAT NC





Set value generation



Setpoint generator



Set value profiles

The profile of the velocity output can be varied during an defined brake time
Thereby the acceleration change (jerk) can be reduced considerably.
This works out on in the short run mechanical burdens and commensurate with as well on the electric burden of the drive.



Set value profiles

„hard“, big
Acceleration change

weich hart

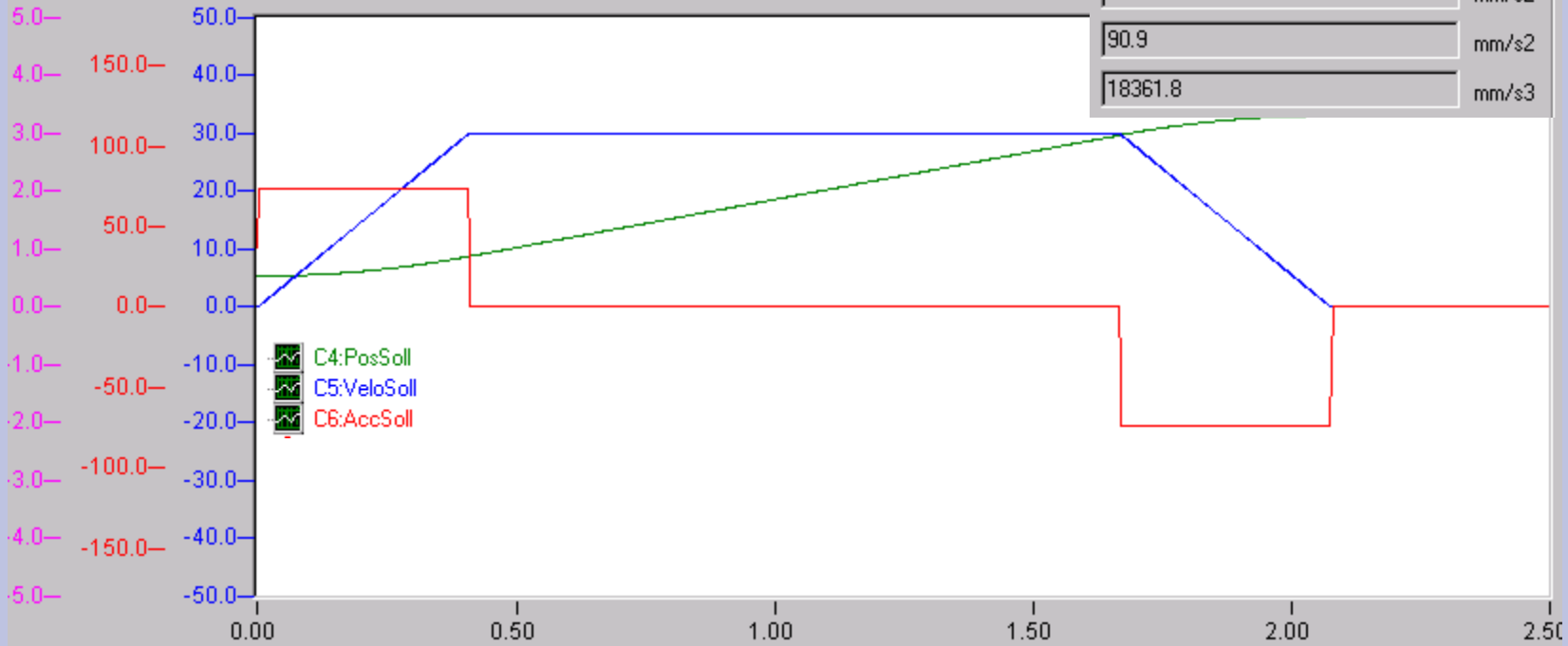
^ ^ ^

~ ~ ~

90.9 mm/s²

90.9 mm/s²

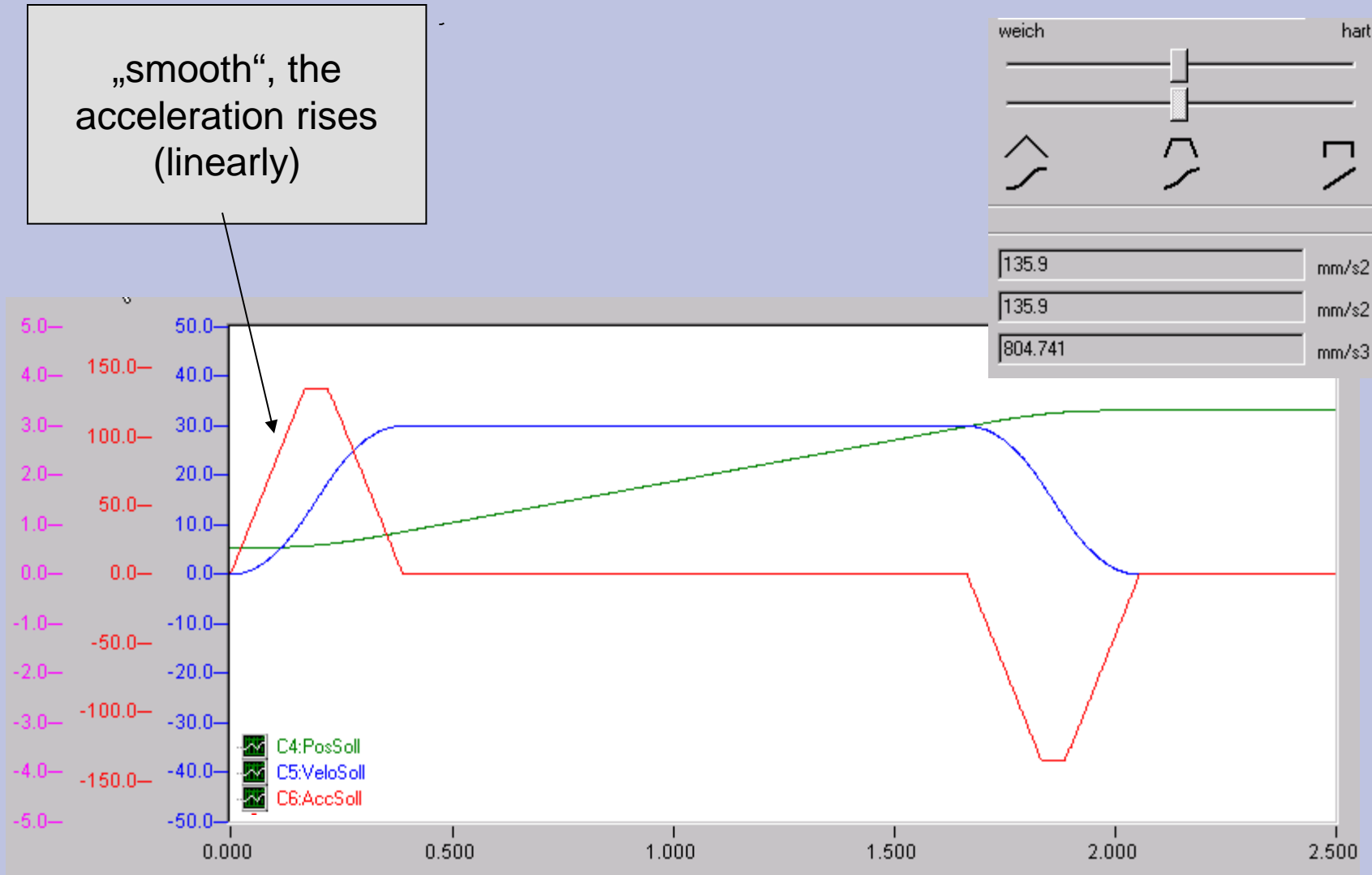
18361.8 mm/s³





Set value profiles

„smooth“, the acceleration rises (linearly)

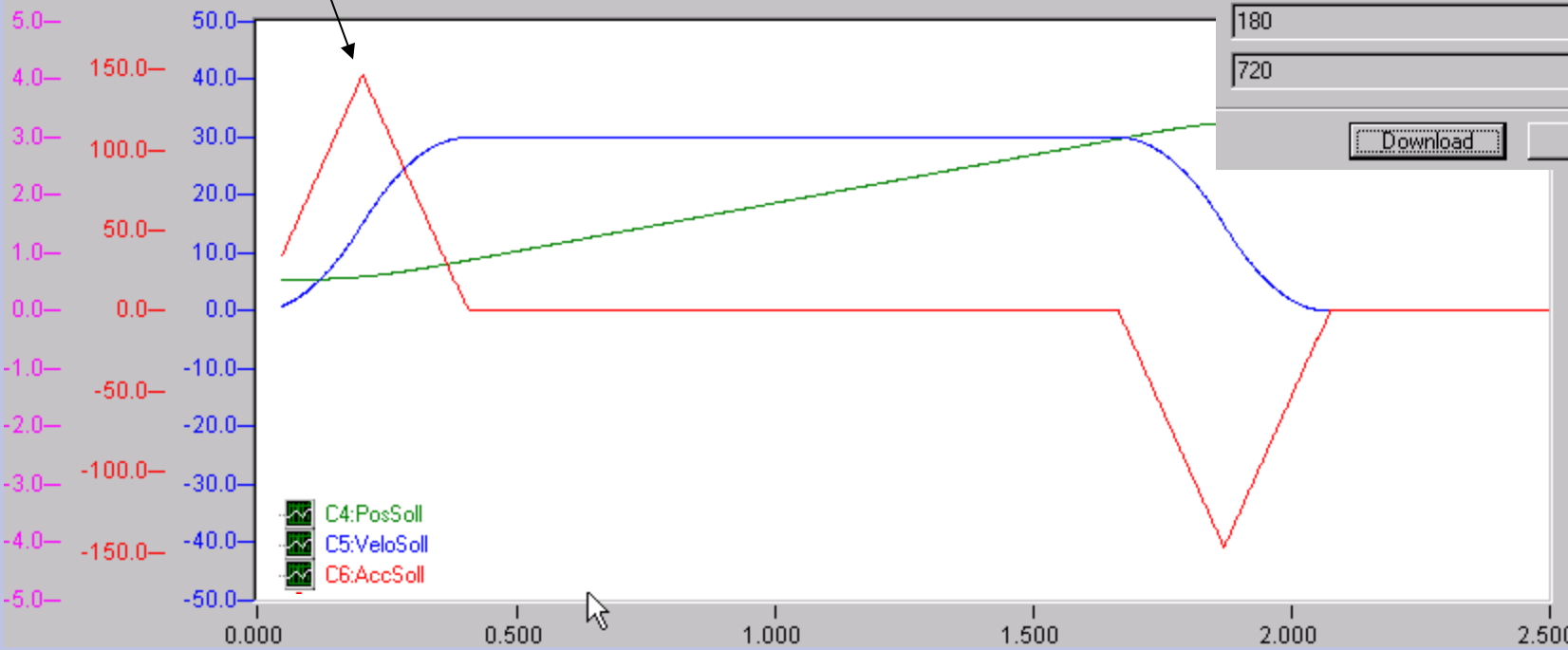




Set value profiles



„most smooth“, the acceleration reaches no more constant phase



weich hart

mm/s²

mm/s²

mm/s³

Download Upload



Set value profiles

Die Vorgabe kann sehr einfach über die Vorgabe der Hochlaufzeit und der Auswahl des Profils im System Manager erfolgen!

Input via run-up time

Preselect profile

Calculation by the TwinCAT System Manager

The screenshot shows the 'Dynamik' configuration window with the following data:

Parameter	Value	Unit
Maximalgeschwindigkeit (V max)	45	mm/s
Hochlaufzeit	2	s
Bremszeit	2	s
Beschleunigung (Direkt)	33.975	mm/s ²
Verzögerung (Direkt)	33.975	mm/s ²
Ruck (Direkt)	50.2963	mm/s ³

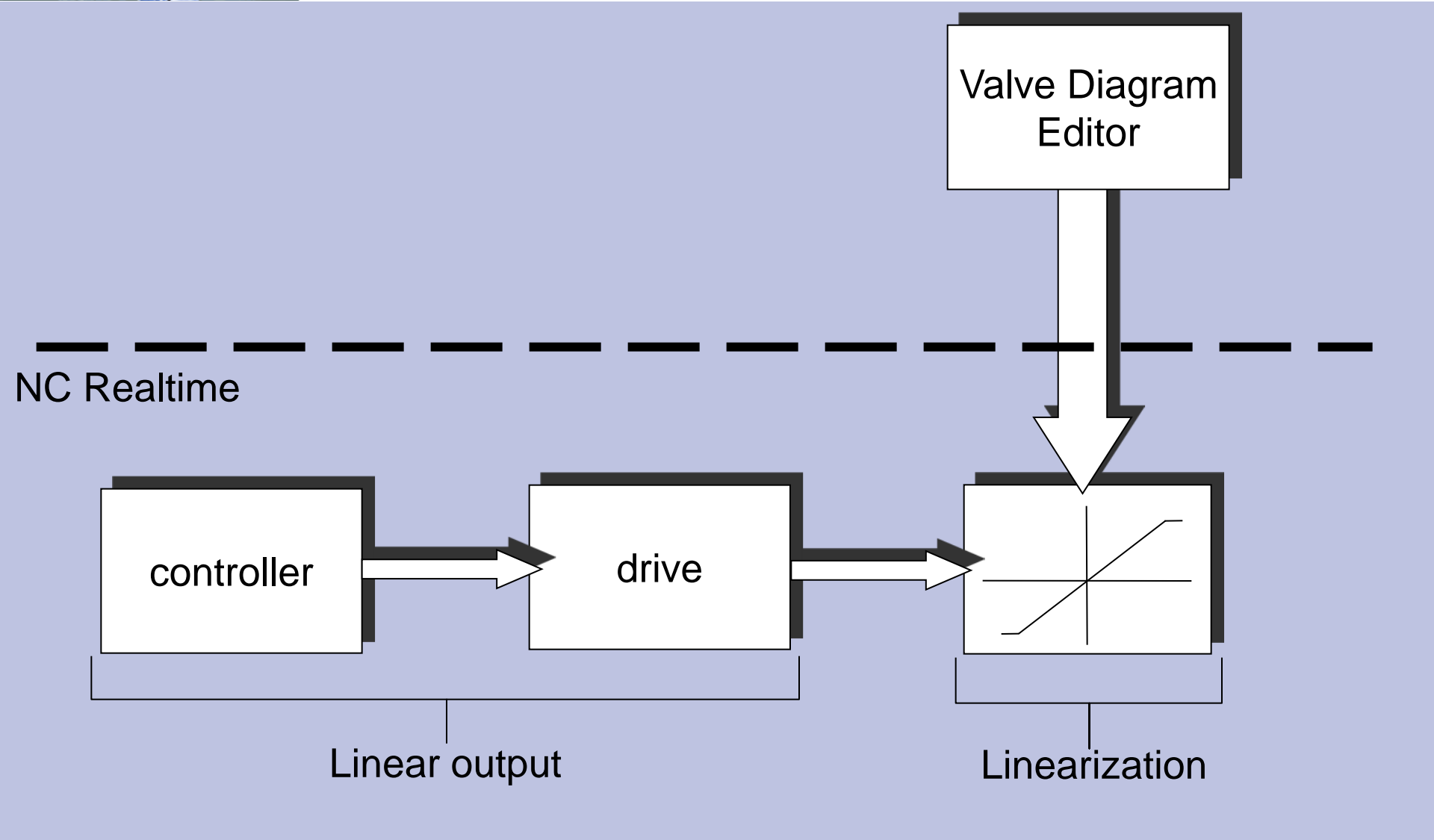


Output Linearisation: TwinCAT Valve Diagram Editor

- Problem: non linear characteristic curves of valves
- Solution
 - Measurement of the curves with the PLC Program
 - import the values to the System Manager
 - graphical Linearisation
 - Interpolation (Polynomial of 5th degree)
 - Load to NC
 - Outputs are linearized



TwinCAT Valve Diagram Editor





TwinCAT Valve Diagram Editor

Testaufbau_Halle.wsm - TwinCAT System Manager

File Edit Actions View Options Help

Real-Time - Configuration
 NC - Configuration
 NC-Task: 1 SAF
 NC-Task: 1 SVB
 NC-Task: 1-Prozessabbild
 Tables
 Master: 1
 KennlinienImport
 KennlinieVentilHalle
 Achsen
 Achse 1
 PLC - Configuration
 Cam - Configuration
 I/O - Configuration
 I/O Devices
 Mappings

Function	Velocity	Velocity [%]	Voltage [%]	Range [%]	Range
1 Synchron	-248.280200	-82.760067	-72.808000		
2 Synchron	-244.190000	-81.396667	-72.438800	0.165667	0.500000
3 Synchron	-240.116700	-80.038900	-72.069500	0.165667	0.500000
4 Synchron	-235.612800	-78.537600	-71.697200	0.165667	0.500000
5 Synchron	-231.603500	-77.201167	-71.327900	0.165667	0.500000
6 Synchron	-226.638000	-75.546000	-70.958600	0.165667	0.500000
7 Synchron	-222.527900	-74.175967	-70.586300	0.165667	0.500000
8 Synchron	-218.042900	-72.680967	-70.217000	0.165667	0.500000
9 Synchron	-213.296700	-71.098900	-69.844700	0.165667	0.500000

80.0

Velocity [%]

Velocity

General Master KennlinienImport KennlinieVentilHalle

Name: KennlinieVentilHalle Table Id: 2

Assigned Axis: Achse 1 Color

Automatic Area Ratio Area Ratio A/B: 1

Velocity
 Percent
 Absolute

Velocity A 100%: 500
 Velocity B 100%: -500

Import Download

Ready

Local (172.16.5.75.1.1) Config Mode



Referencing

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Teil II Practical Part:

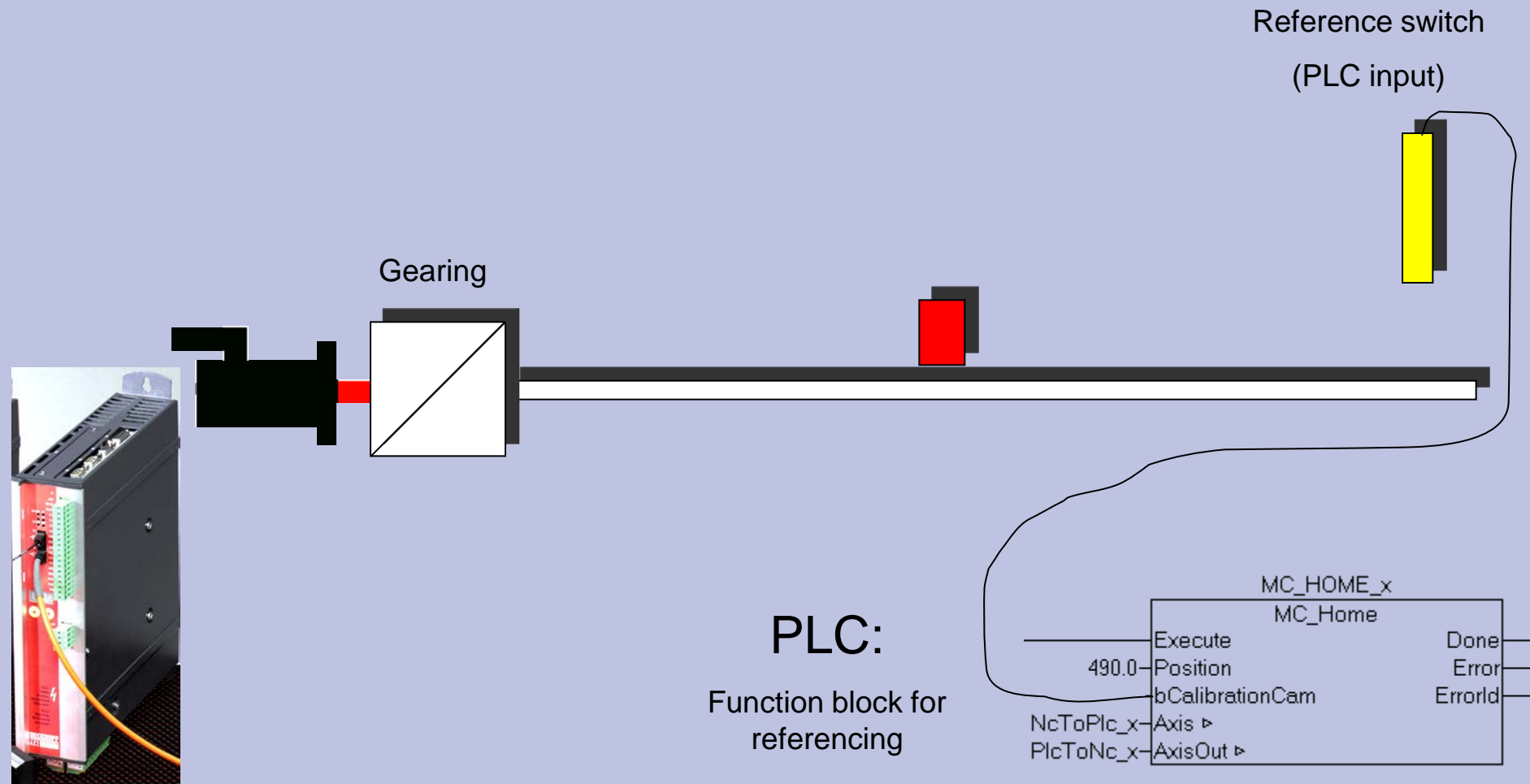
- Setting up NC axes in the System Manager
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Referencing (calibrate) is necessary for axis with not absolute encoder systems.
Incremental Encoder, Single Turn Absolute Encoder, or not absolute encoder systems direct from the drive, (e.g. actual position value of AX2000).

At referencing the axis is lead to a fix reference position and the encoder is set to the current actual position.

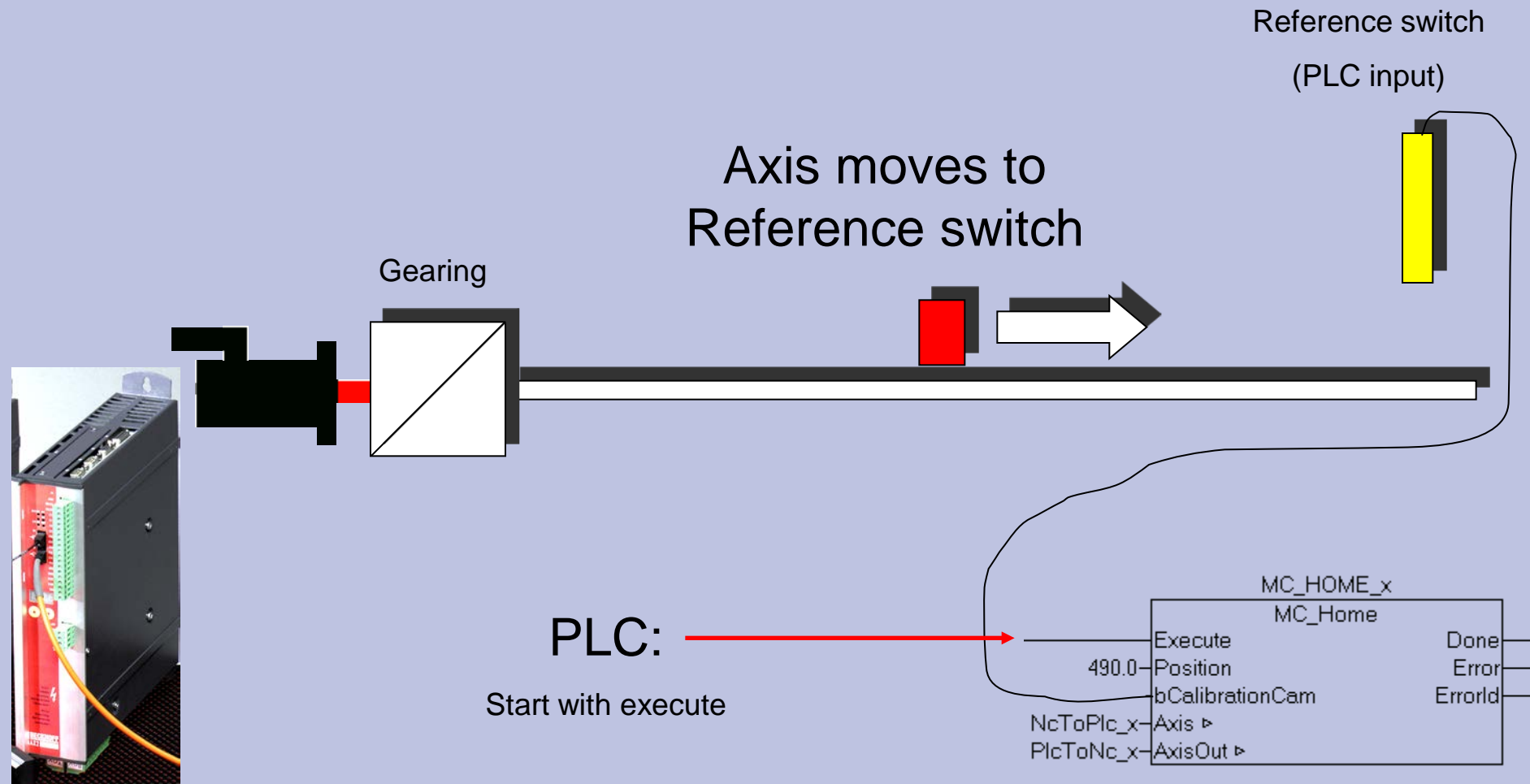


Referencing initial state





Referencing

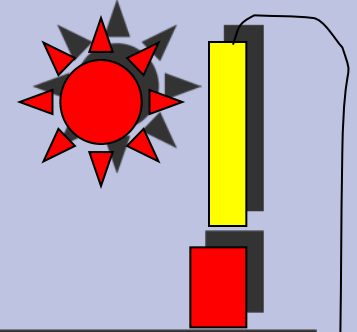




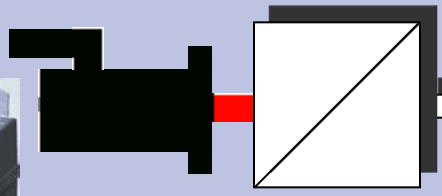
Referencing

Reference switch was reached, axis breaks

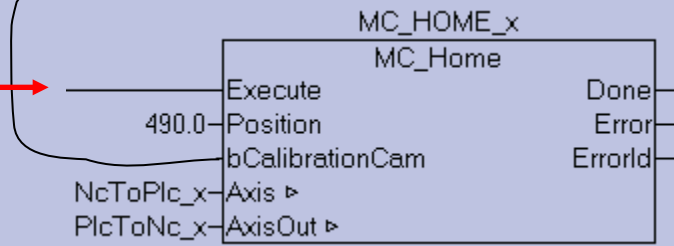
Reference switch
(PLC input)



Gearing



PLC:
Start with execute



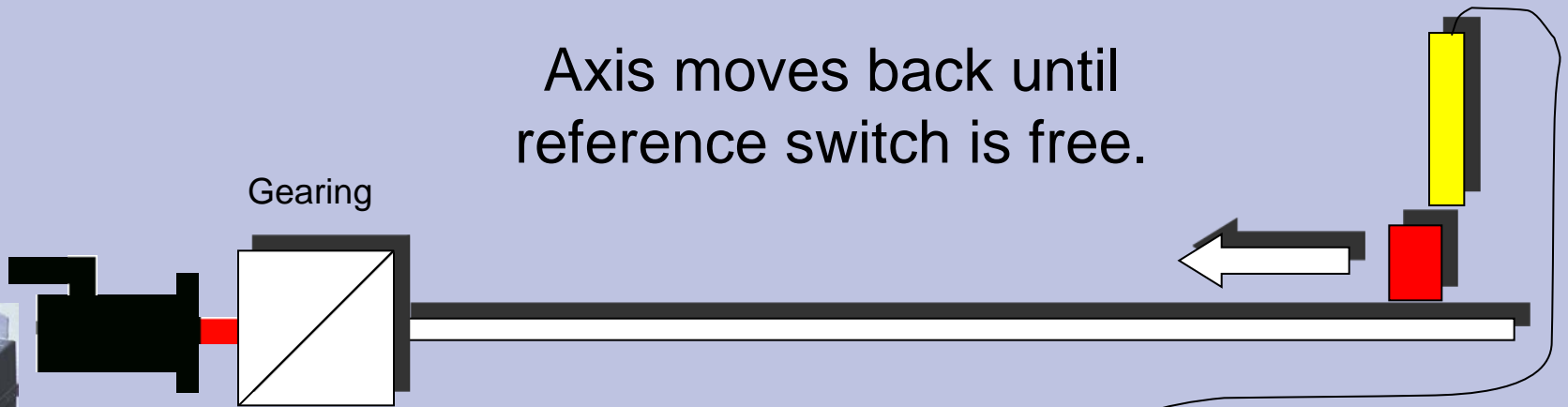


Referencing

Axis moves back until reference switch is free.

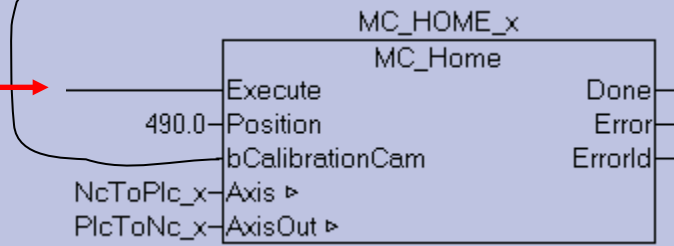
Reference switch
(PLC input)

Gearing



PLC:

Start with execute





Referencing completed (a)

Axis breaks, actual position is set

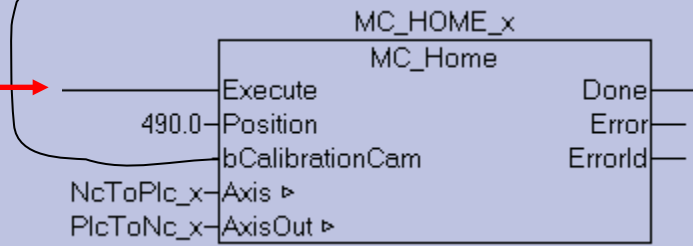
Reference switch
(PLC input)



Gearing



PLC:
Start with execute





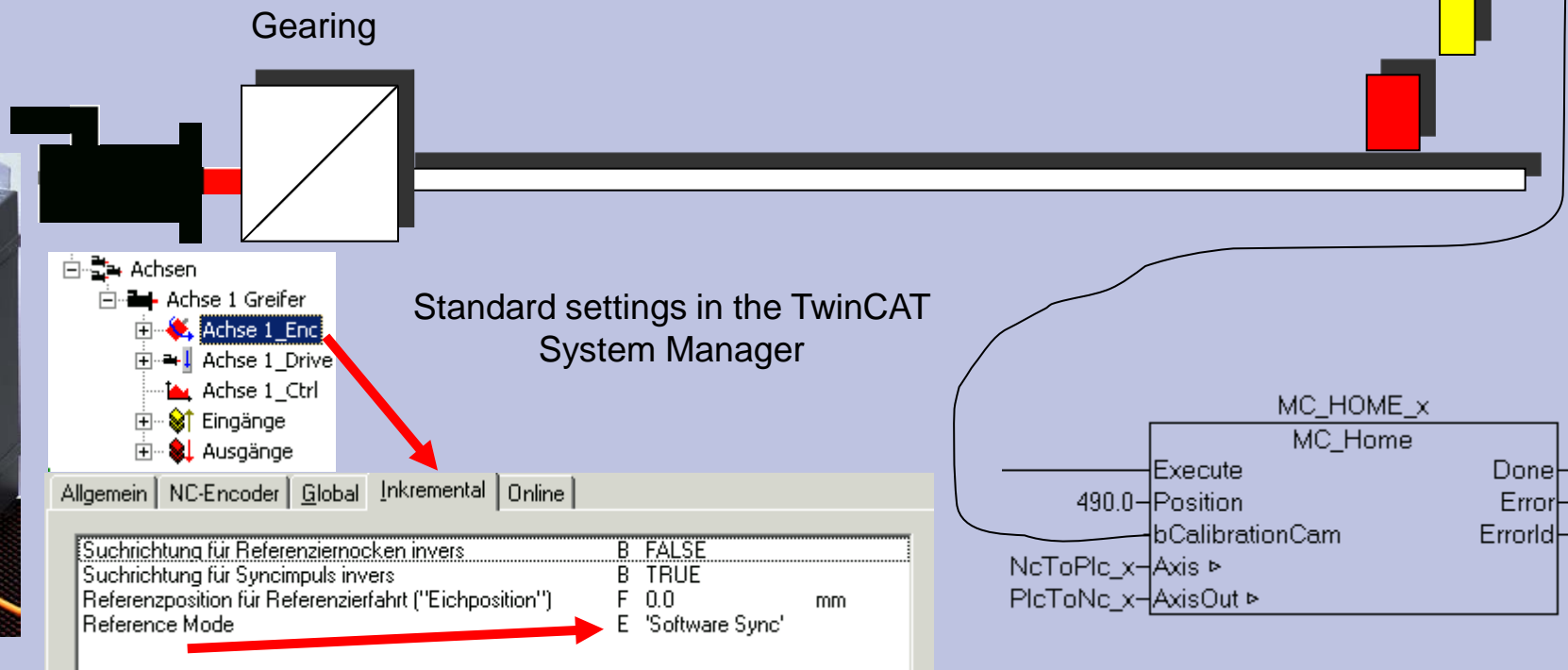
Referencing completed (b)

AX2000:

After leaving the reference switch, TwinCAT NC waits for the "Syncsignal" of AX2000 and then stops.

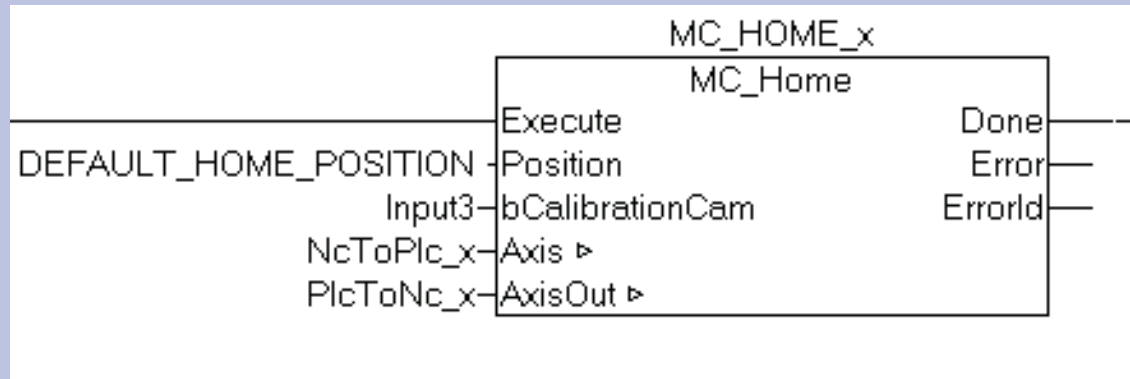
Advantage: more exactly. The set position in the standstill of the axis is calculated with the internal latch of the AX2000 (corresponds to the zero signal at Incremental encoders)

Reference switch
(PLC input)





Referencing completed. Which position is set?



If „Position“ **DEFAULT_HOME_POSITION** (global variable from TCMC.LIB) is submitted at the Fb input, the value is taken out of the System Manager.

Otherwise the value is taken at the input „Position“

Allgemein		NC-Encoder	Global	Inkremental	Online
Suchrichtung für Referenziertocken invers	B	FALSE			
Suchrichtung für Syncimpuls invers	B	TRUE			
Referenzposition für Referenzierfahrt (Eichposition)	*	F	490.0	mm	
Reference Mode	E	'Software Sync'			



Motion Control Function blocks

Target: IEC61131-3 compatible programming interface for motion tasks



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Motion Control Function blocks

Why a standard?

-Hardware independent Programming

-the same look and feel, identical Syntax

-IEC 61131-3 as Base

-Expansions for new application areas possible

-TwinCAT: Combination of MC blocks and TwinCAT specific Axis blocks possible.

⇒ Existing applications can be expanded with IEC Motion Control blocks, without a new writing of the e... flows.

Beckhoff:

Beispiel : es müssen nicht unbedingt alle FB's aus der spec vorhanden sein



Motion Control Function blocks

Defined in:

The PLCopen Task Force Motion Control by Manufacturer and end user

- ◆ Atlas Copco Control
- ◆ Baumuller
- ◆ Beckhoff
- ◆ Control Techniques
- ◆ Elau
- ◆ Giddings & Lewis
- ◆ Indramat
- ◆ Infoteam Software
- ◆ KW Software
- ◆ Lenze
- ◆ Siemens
- ◆ Softing

TetraPak

Rovema Packaging Machines

Ford

General Motors

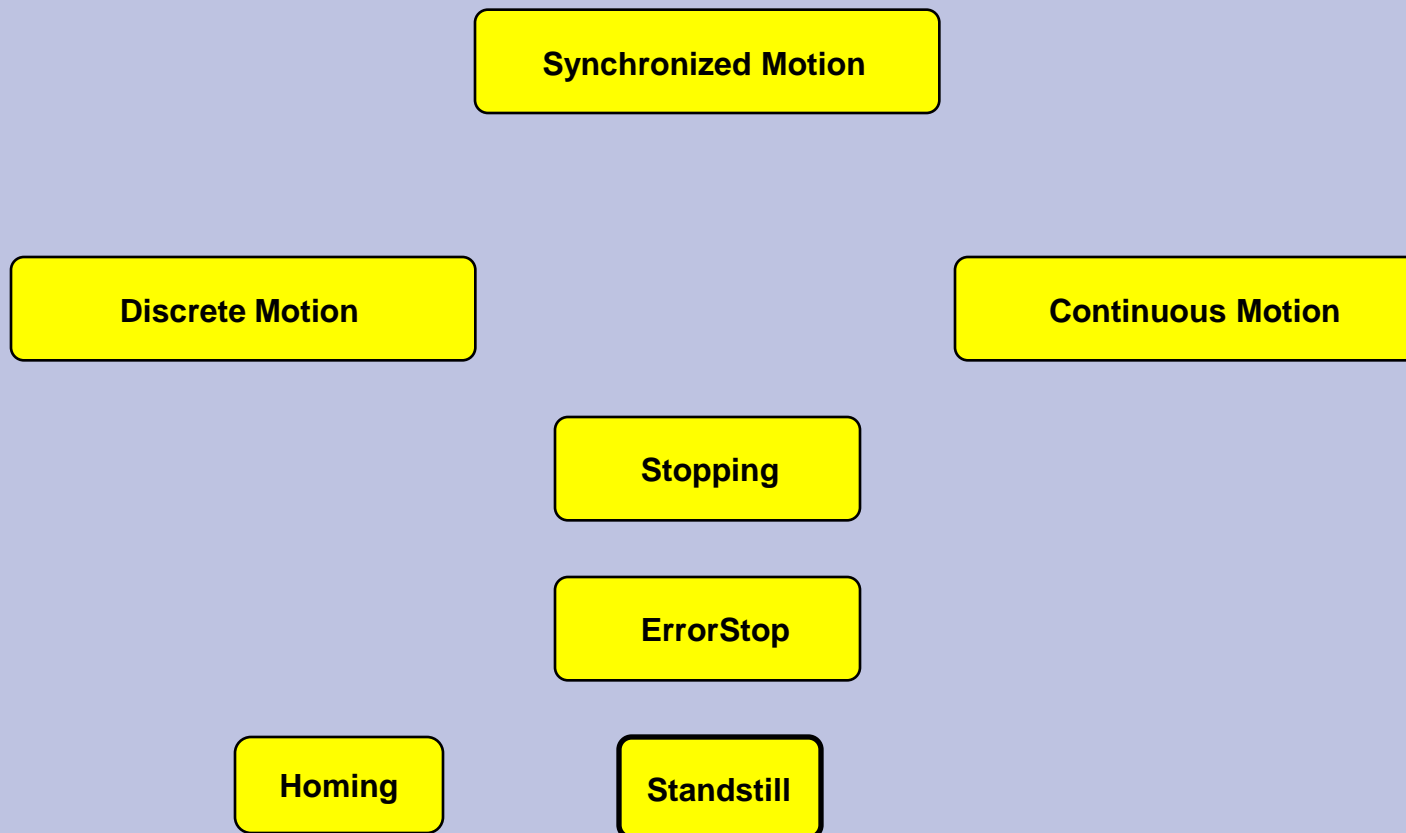
Root: Task Force Motion Control presentation Version Febr2002. (www.plcopen.org)

Beckhoff:

Beispiel : es
müssen nicht
unbedingt alle
FB's aus der spec
vorhanden sein

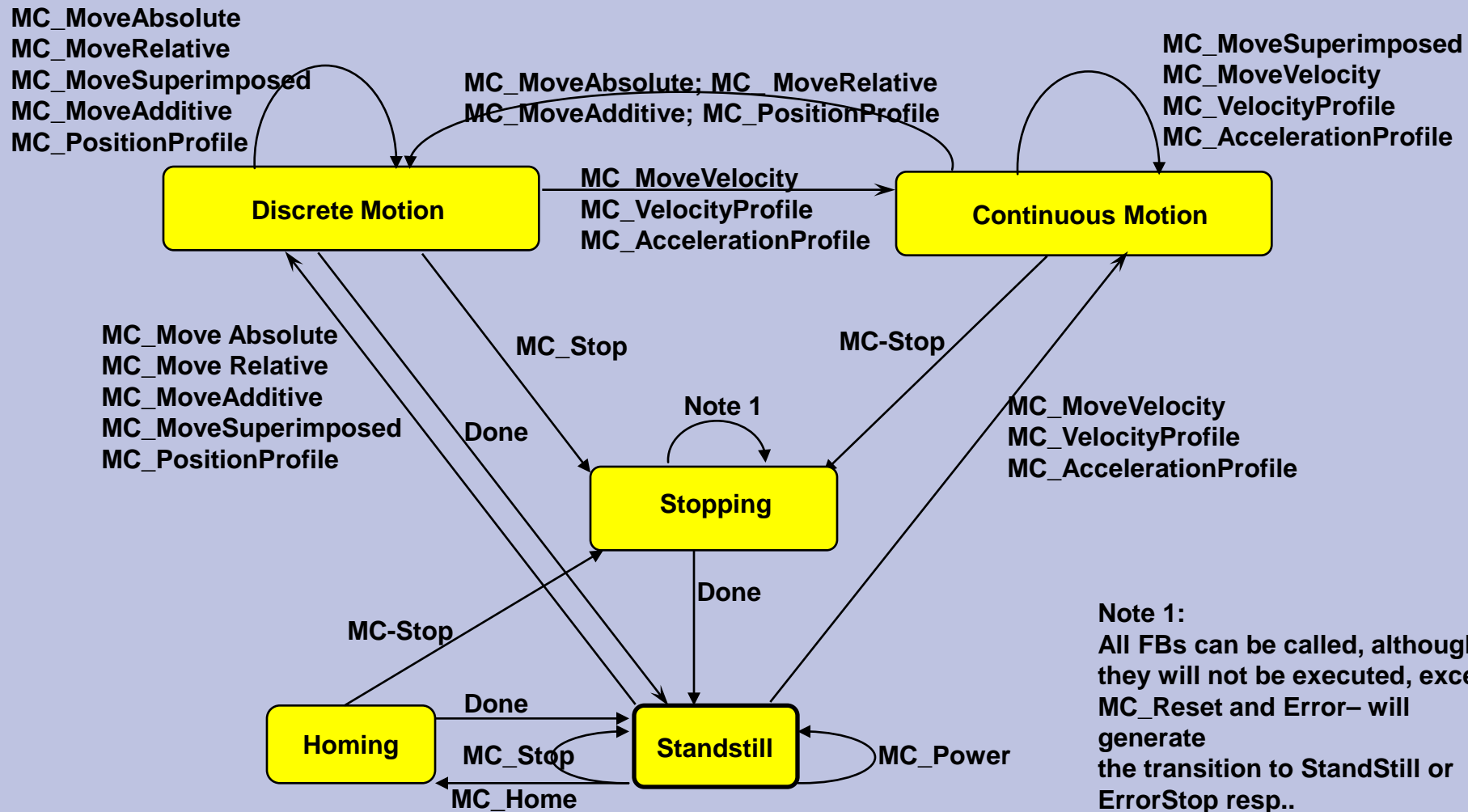


Statemachine:





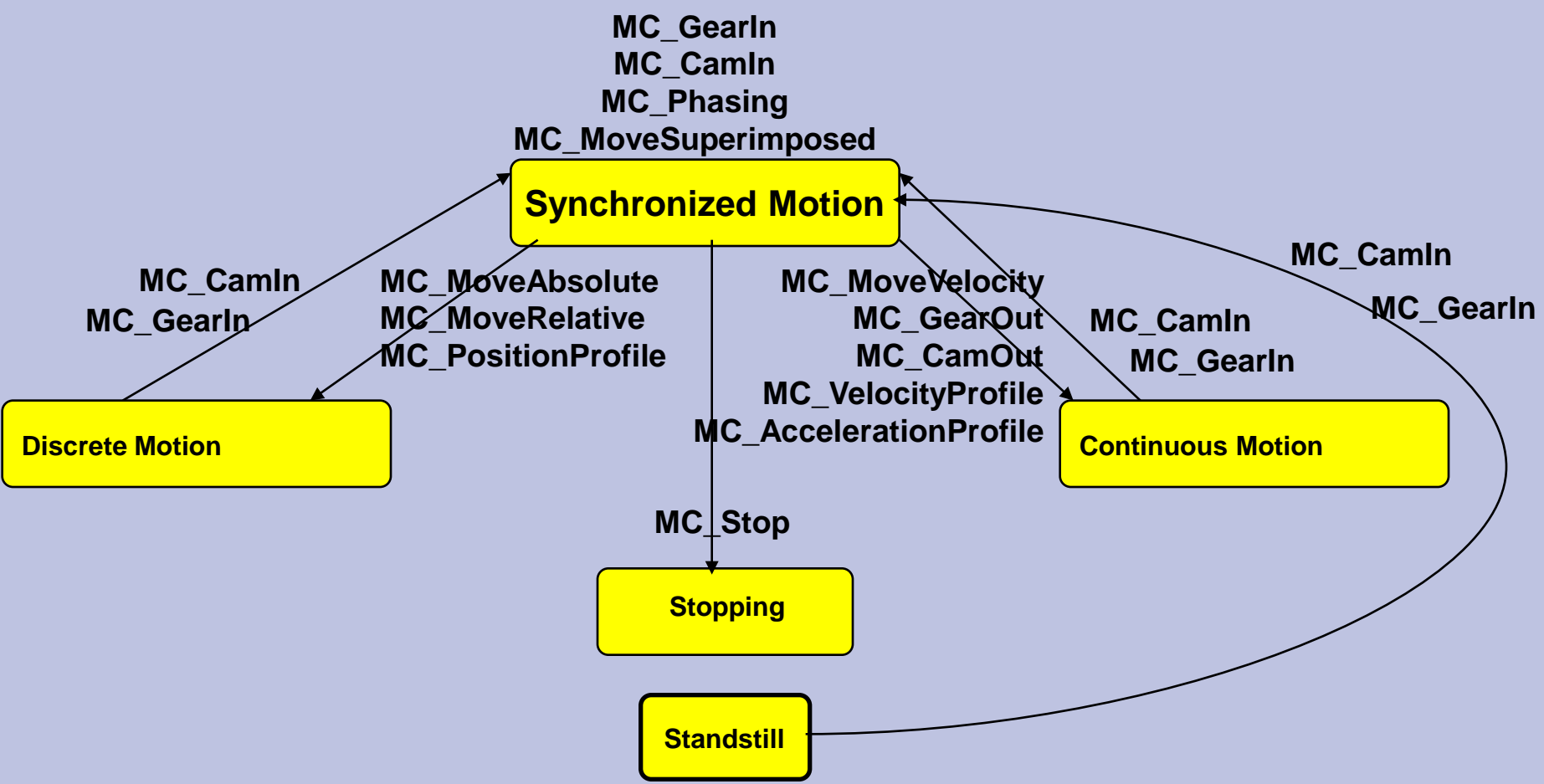
Statemachine:



Note 1:
 All FBs can be called, although they will not be executed, except MC_Reset and Error- will generate the transition to StandStill or ErrorStop resp..

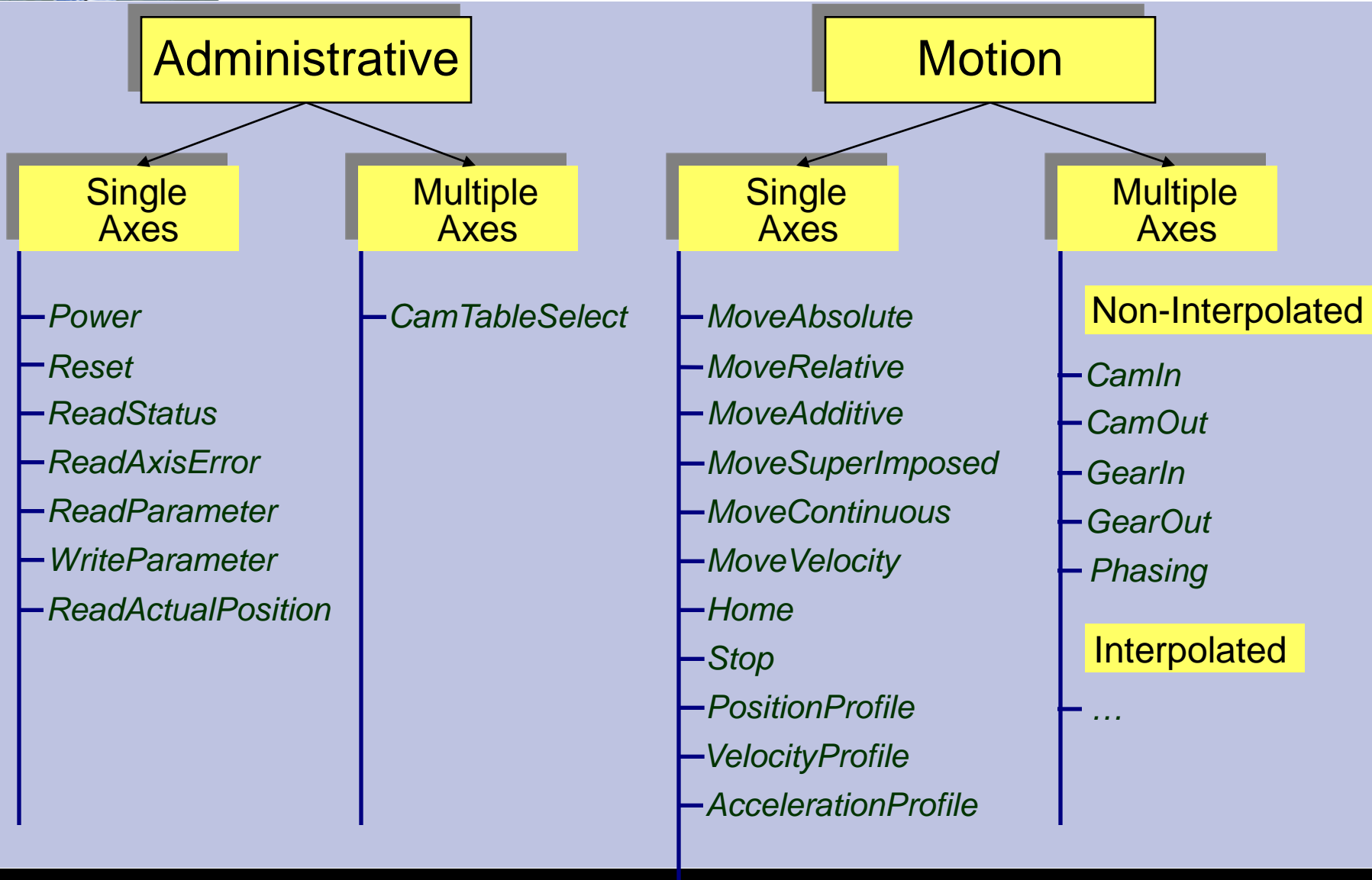


Statemachine Synchronized Motion



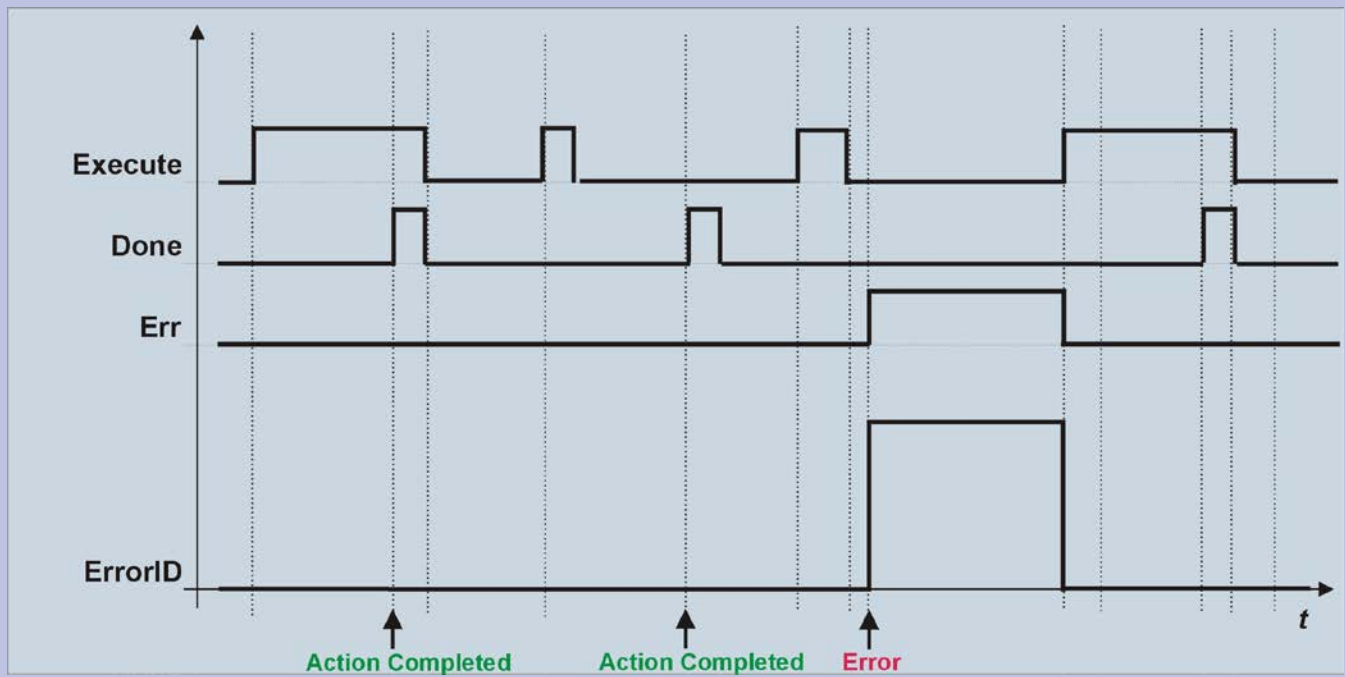
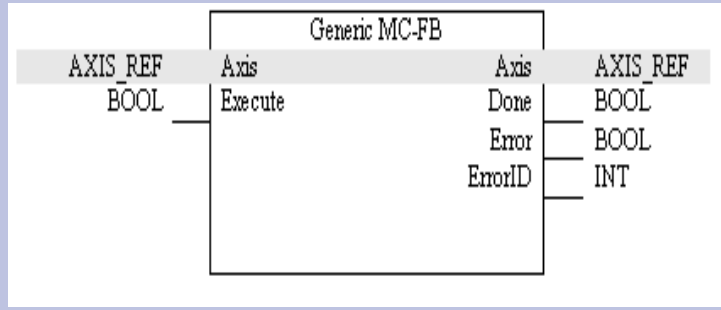


Overview Function Block Class:





Standardized Handshake



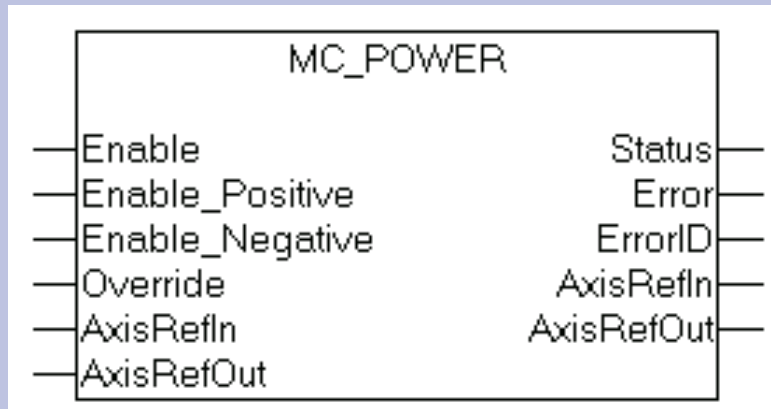


FB's

Administrative Function Blocks



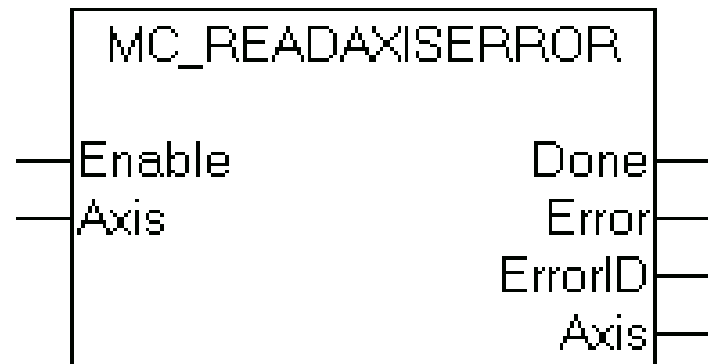
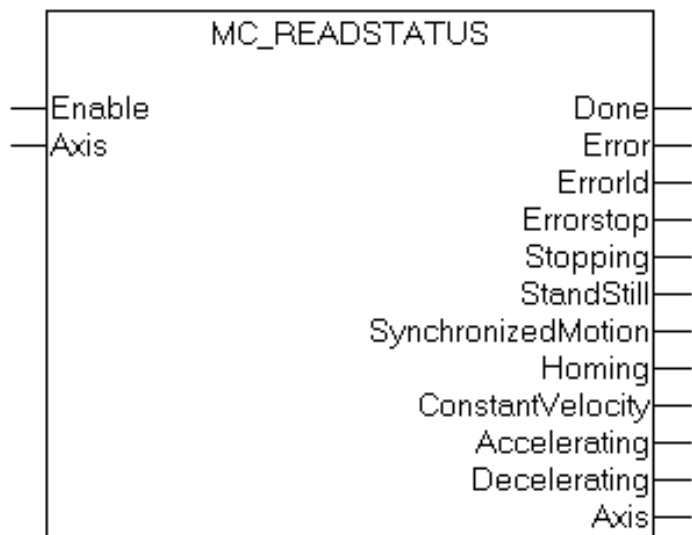
MC Power



Enable	Enable_Positive	Enable_Negative	NC Controller allows:
1	0	0	Position control
1	1	0	Position control + Start in positive direction
1	0	1	Position control + Start in negative direction
1	1	1	Position control + Start in positive or negative direction

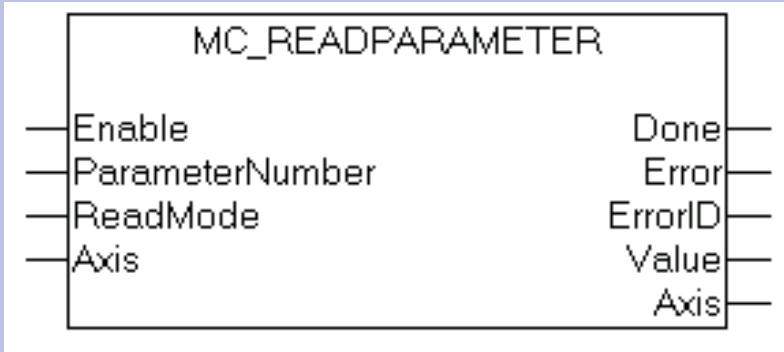
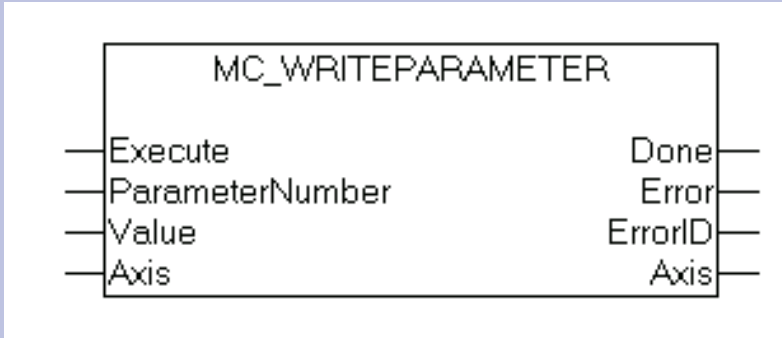


MC_Read_...



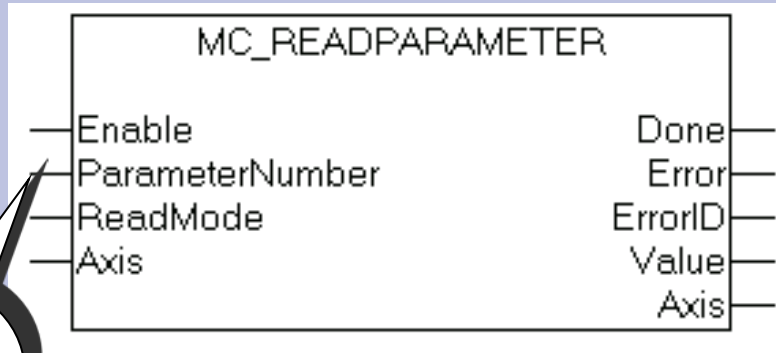


MC Read_...



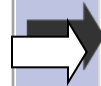


MC Read /Write Parameter Number in TCMC.LIB



PLC Control Library
Manager

- TcNC.lib*16.10.02 09:05:00
- TcMC.lib*16.10.02 09:05:00**
- STANDARD.LIB*5.6.98 09:05:02
- TcBase.lib*16.9.02 09:05:02
- TcSystem.lib*16.9.02 09:05:02




```

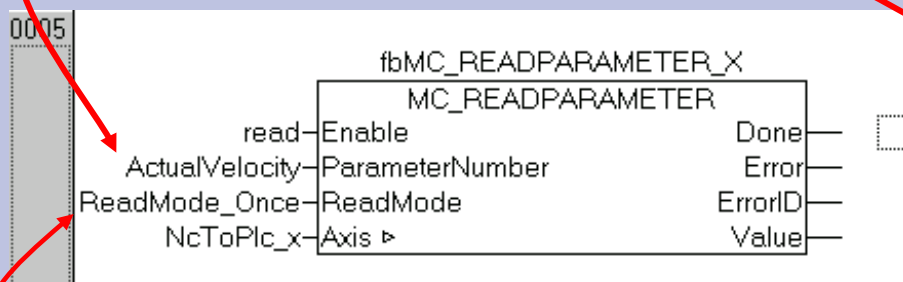
TYPE MC_AxisPara : (
(*
    PLCopen specific parameters *)
    CommandedPosition := 1, (* Ireal *)
    SWLimitPos, (* Ireal *)
    SWLimitNeg, (* Ireal *)
    EnableLimitPos, (* bool *)
    EnableLimitNeg, (* bool *)
    EnablePosLagMonitoring, (* bool *)
    MaxPositionLag, (* Ireal *)
    MaxVelocitySystem, (* Ireal *)
    MaxVelocityAppl, (* Ireal *)
    ActualVelocity, (* Ireal *)
    CommandedVelocity, (* Ireal *)
    MaxAccelerationSystem, (* Ireal *)
    MaxAccelerationAppl, (* Ireal *)
    MaxDecelerationSystem, (* Ireal *)
    MaxDecelerationAppl, (* Ireal *)
    MaxJerk, (* Ireal *)
(*
    Beckhoff specific parameters *)
    AxisId := 1000, (* Ireal *)
    AxisVeloManSlow, (* Ireal *)
    AxisVeloManFast, (* Ireal *)

```





Example Read ActualVelocity



```

TYPE MC_AxisPara : (
(*
    PLCopen specific parameters *)
    CommandedPosition := 1, (* Ireal *)
    SWLimitPos, (* Ireal *)
    SWLimitNeg, (* Ireal *)
    EnableLimitPos, (* bool *)
    EnableLimitNeg, (* bool *)
    EnablePosLagMonitoring, (* bool *)
    MaxPositionLag, (* Ireal *)
    MaxVelocitySystem, (* Ireal *)
    MaxVelocityAppl, (* Ireal *)
    ActualVelocity, (* Ireal *)
    CommandedVelocity, (* Ireal *)
    MaxAccelerationSystem, (* Ireal *)
    MaxAccelerationAppl, (* Ireal *)
    MaxDecelerationSystem, (* Ireal *)
    MaxDecelerationAppl, (* Ireal *)
    MaxJerk, (* Ireal *)
(*
    Beckhoff specific parameters *)
    AxisId := 1000, (* Ireal *)
    AxisVeloManSlow, (* Ireal *)
    AxisVeloManFast (* Ireal *)
)
    
```

With ReadMode the single resp. permanent reading can be determined.

```

TYPE
    E_ReadMode :
    (
        ReadMode_Once := 1,
        ReadMode_Cyclic
    );
END_TYPE
    
```

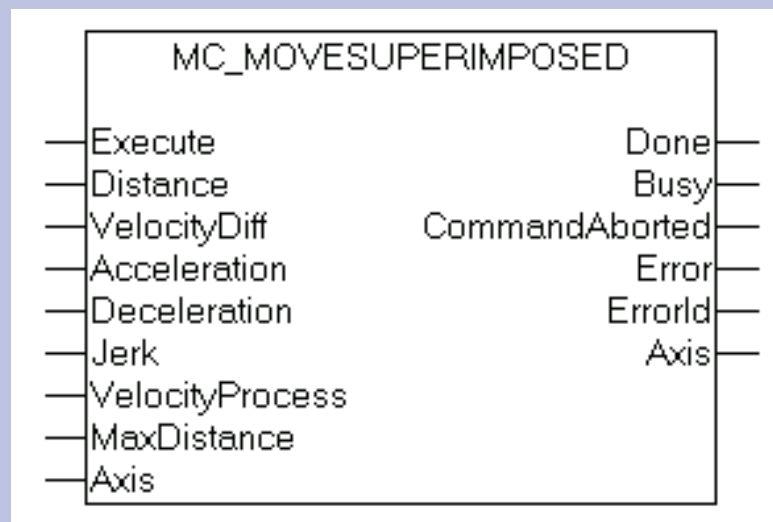
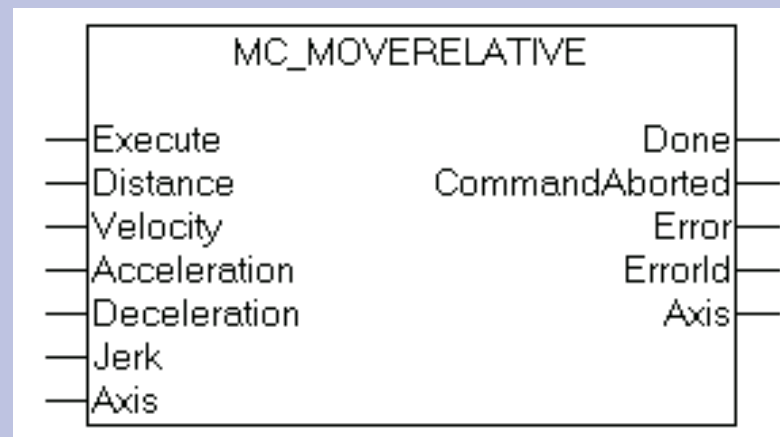
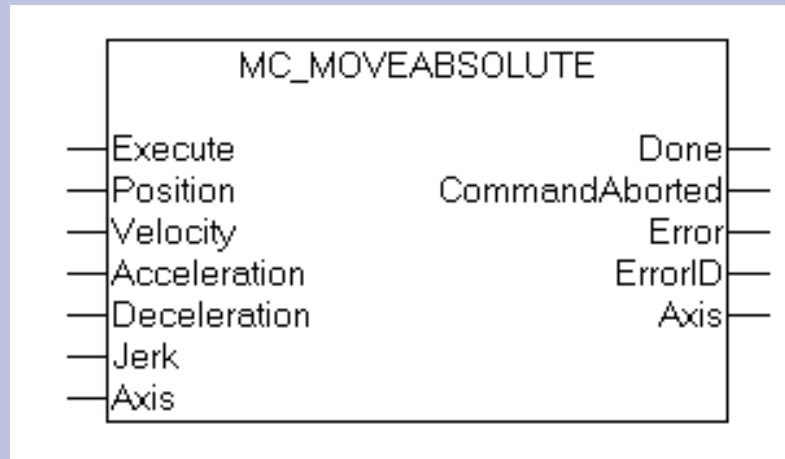


Motion Function Blocks

Single Axis Motion Function Blocks

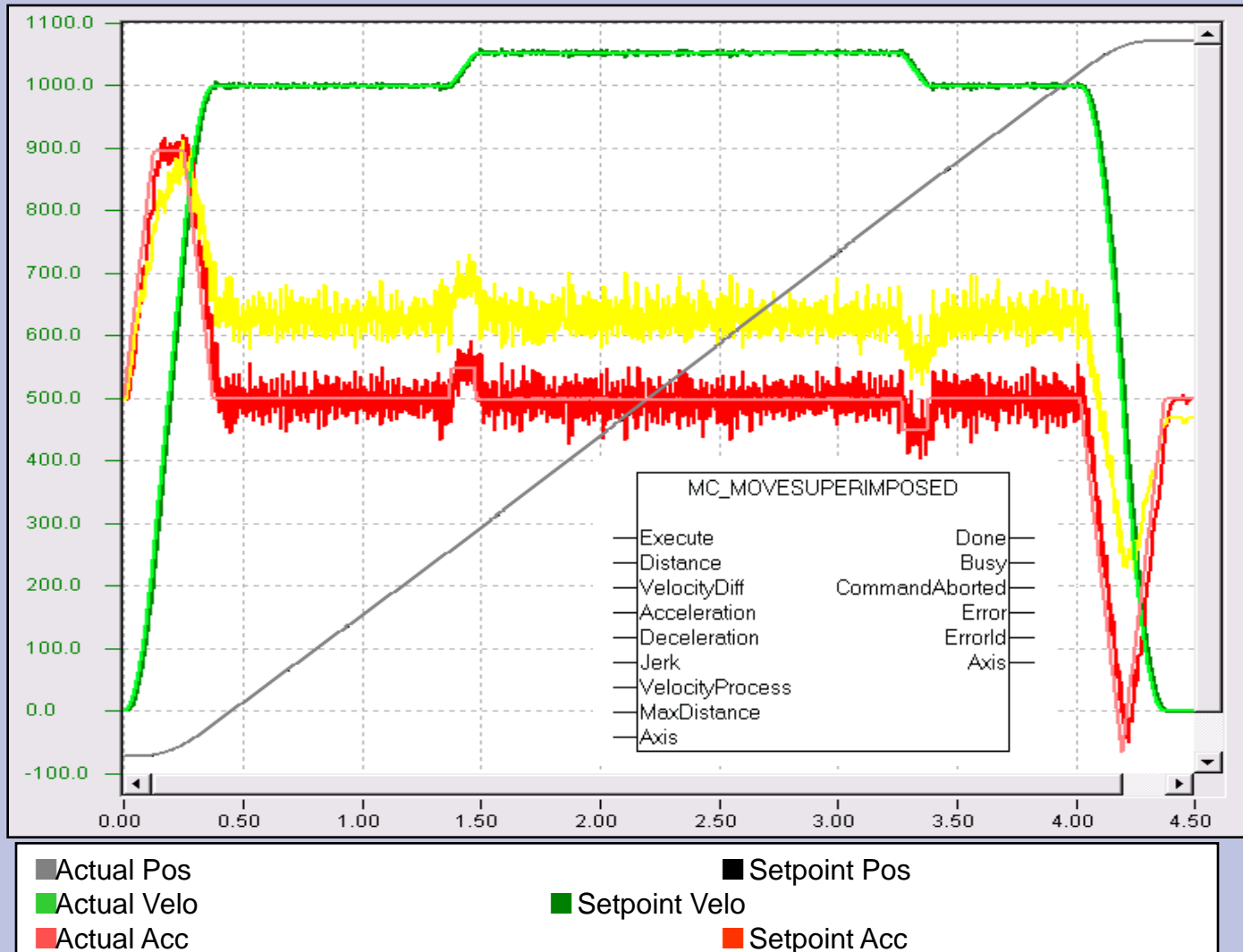


Motion Function Blocks



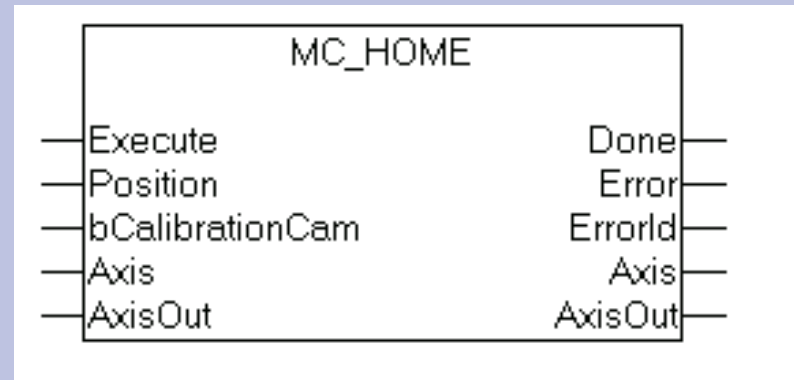
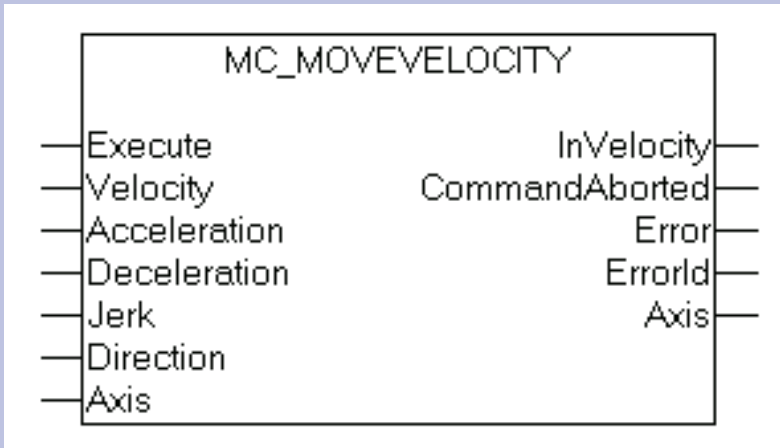


Mode of Operation Move Superimposed





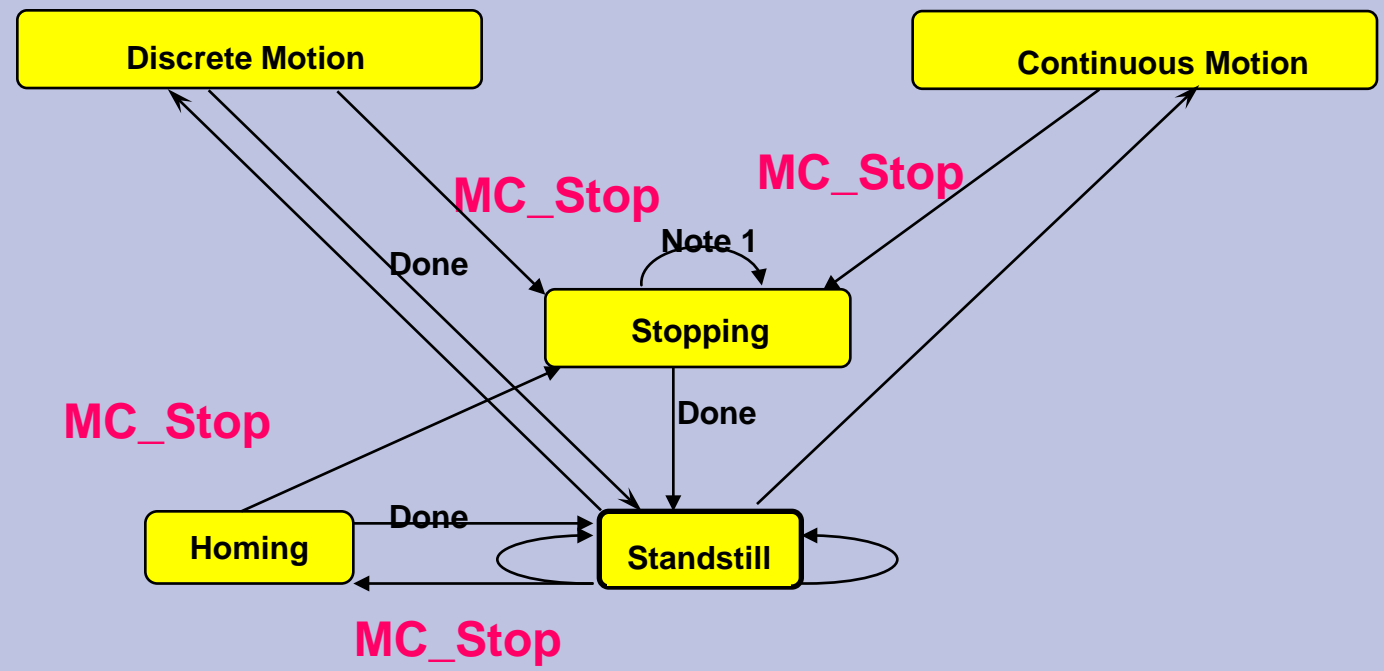
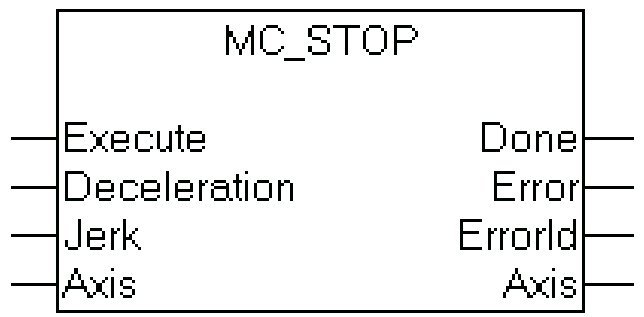
Motion Function Blocks



Mode of operation see „[Referencing](#)“



Motion Function Blocks





Motion Function Blocks Multiple Axis

Multiple Axis Motion Function Blocks (non-interpolated)



Motion Function Blocks Multiple Axis

GEARING is the activation of a numeric ratio between master and slave axis.
(comparable with a mechanical gearbox).

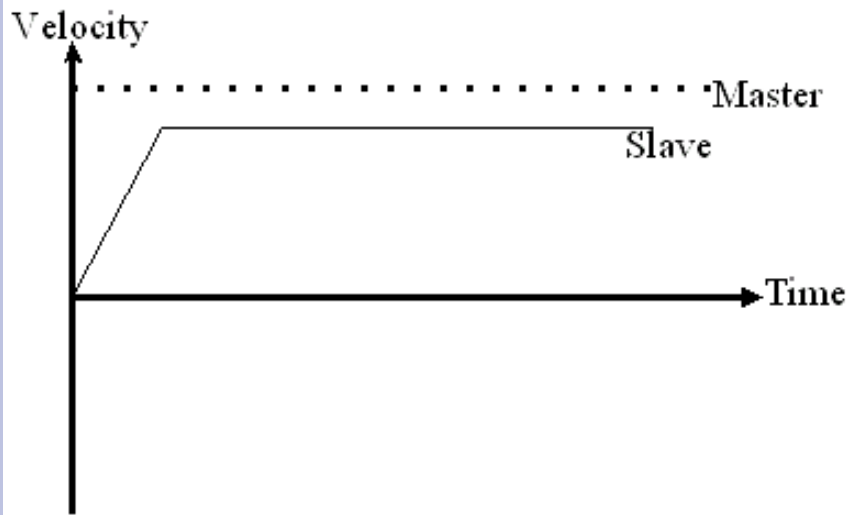


Motion Function Blocks Multiple Axis

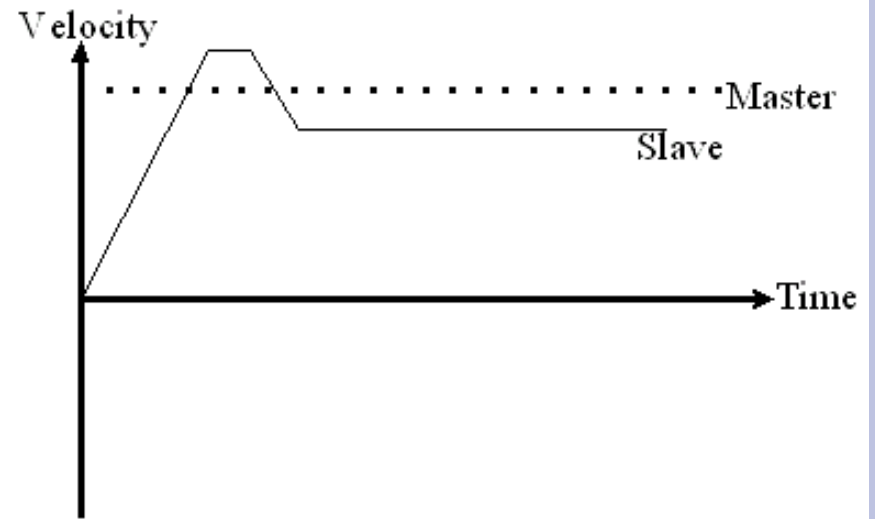
Linear “gearbox”
fixed ratio of transmission : V_m/V_s

“Flying Saw”

Non-rigid coupled Gear (velocity gear only)



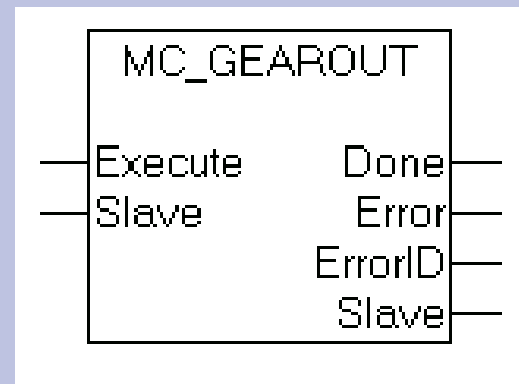
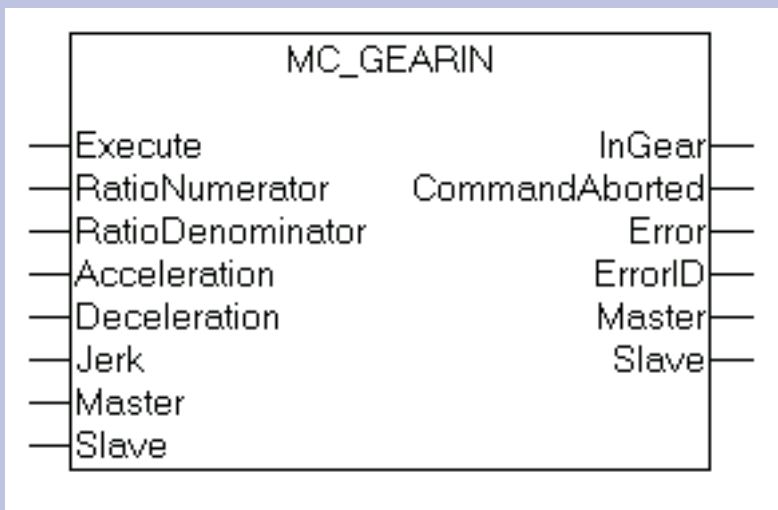
Rigid coupled Gear (velocity + pos. gear)





Motion Function Blocks Multiple Axis

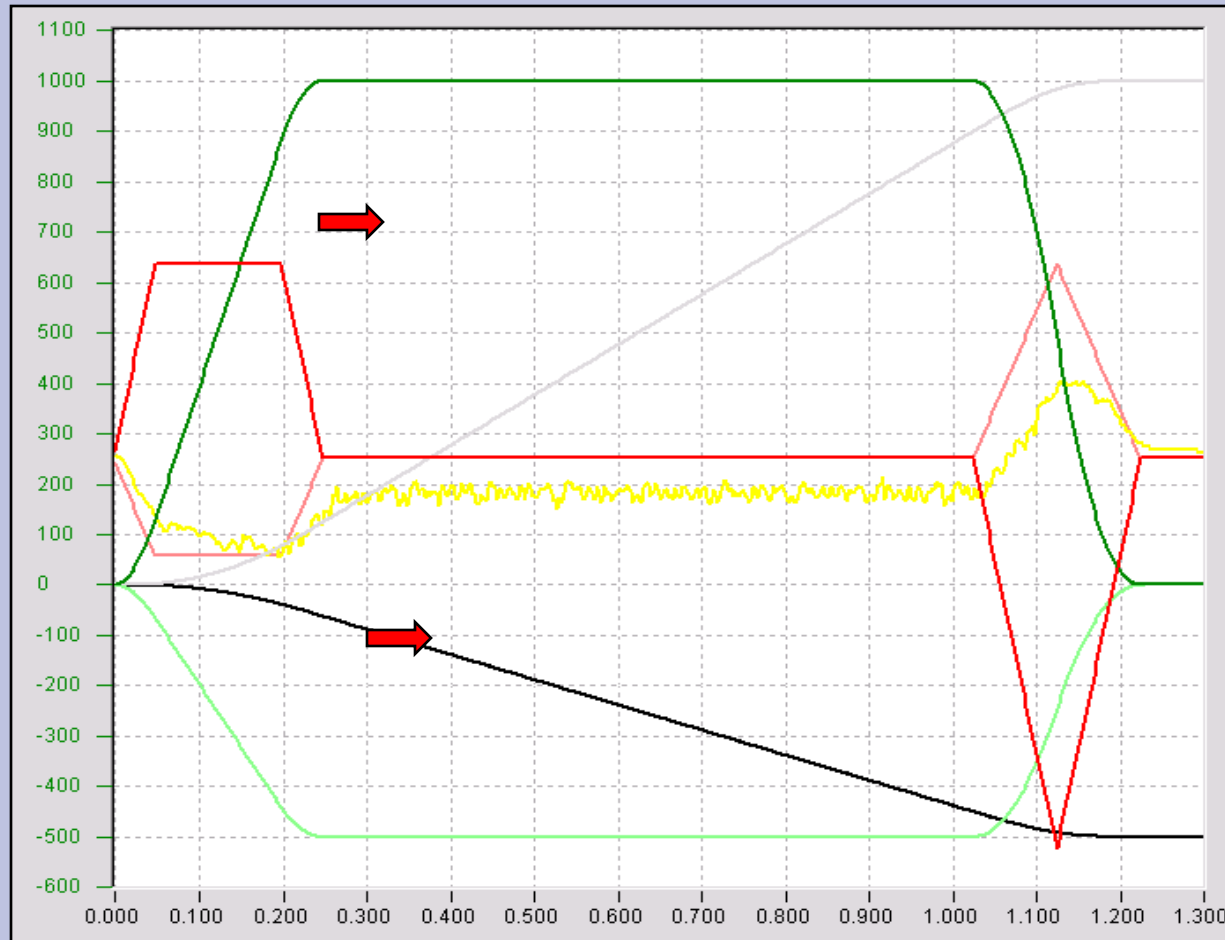
MOTION DIAGRAM FOR GEARING





Motion Function Blocks Multiple Axis

Movement diagram



- Slave PosSetpoint
- Master PosSetpoint
- Position Lag
- Master VeloSetpoint
- Slave VeloSetpoint
- Master AccelSetpoint
- Slave AccelSetpoint



Practical Part

Setting up NC Axes in System Manager

Note: These bitmaps show all basic steps in the System Manager in for AX2000. Not all possible combinations are shown.
Furthermore the **Safety instructions** are to be considered absolutely.

TwinCAT Information System NC -> **Safety functionalities.**



- Part I General
- Overview
- Axis types
- Functional principle
- Referencing
- Motion Control Function Blocks

- Teil II Practical Part:
- Setting up NC axes in the System Manager
 - Starting NC axes from the PLC

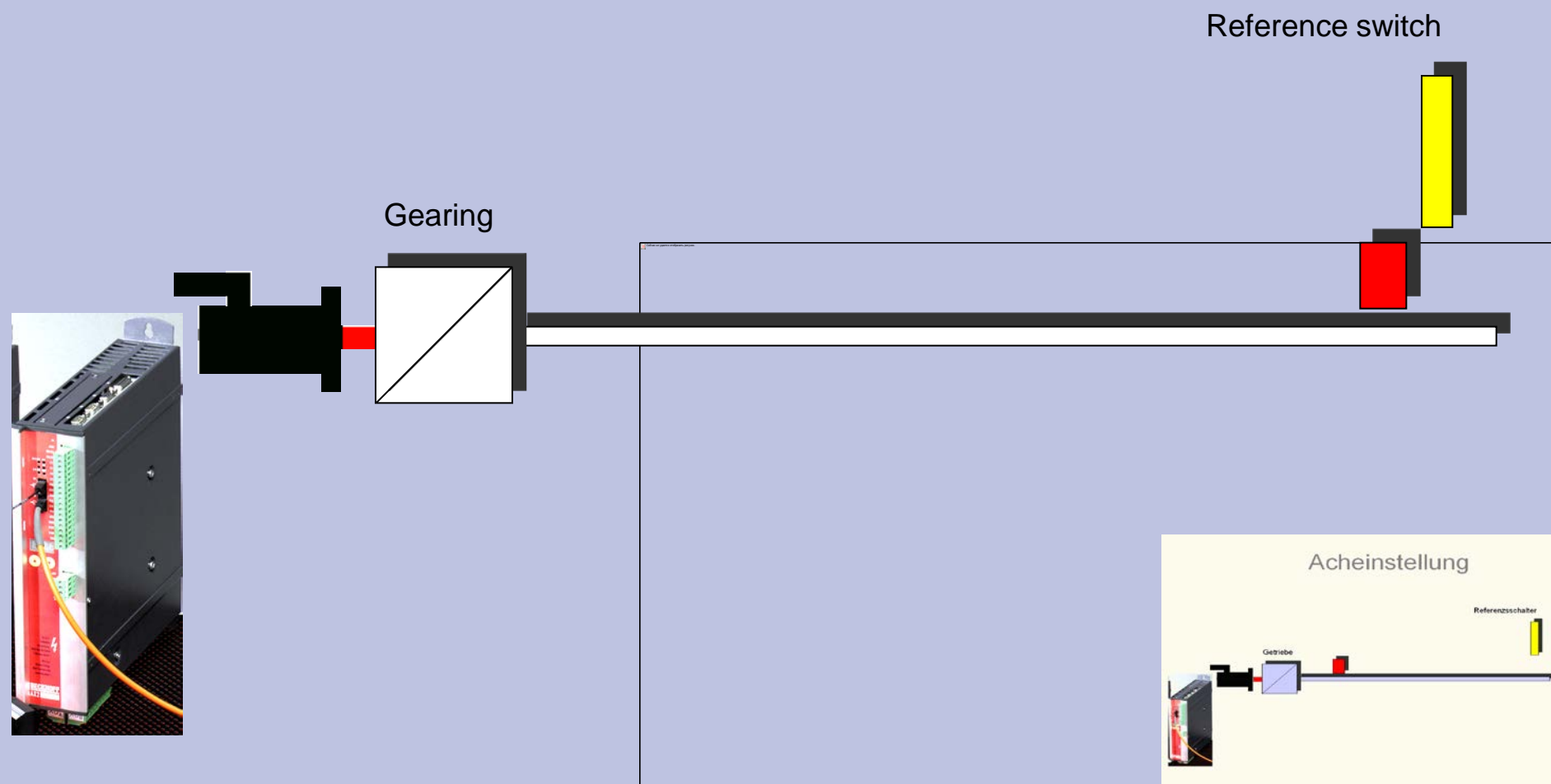


Axes Settings

Example configuration	
Data AX2000: Settings at the training devices	
Max. r.p.m.	3000
Increments per Motor revolution (Encoderemulation of AX2000)	65535
Adopted mechanical ration	1 motor revolution is equivalent to 1mm mechanical way

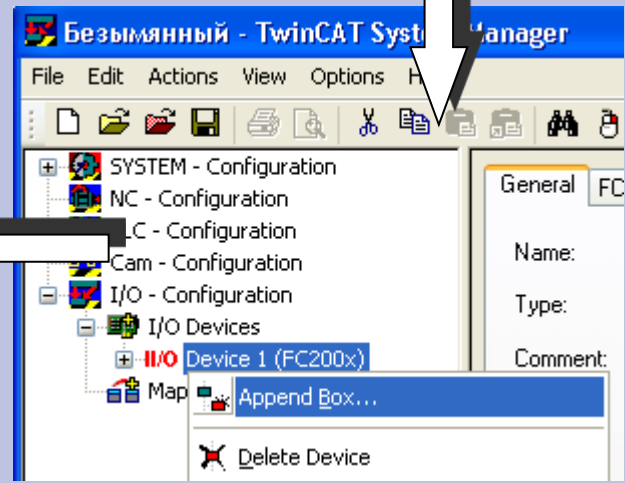
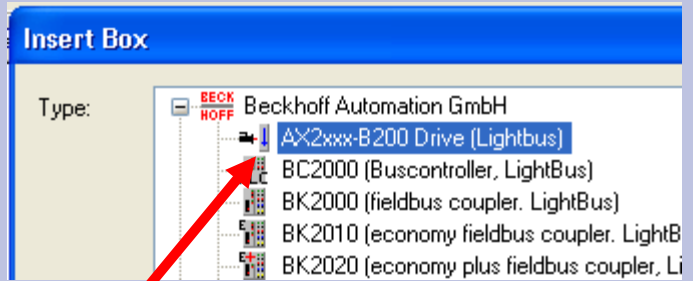
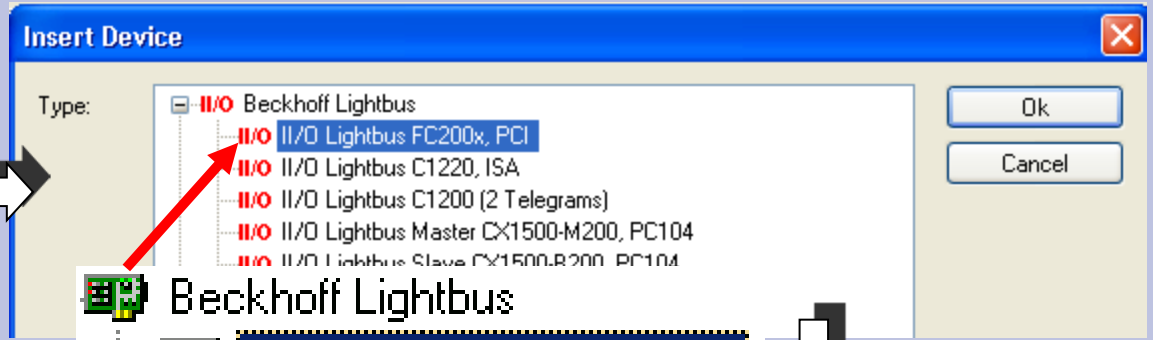
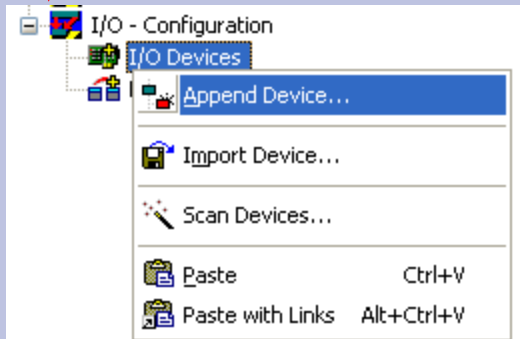


Axes Settings (adopted Application modell)



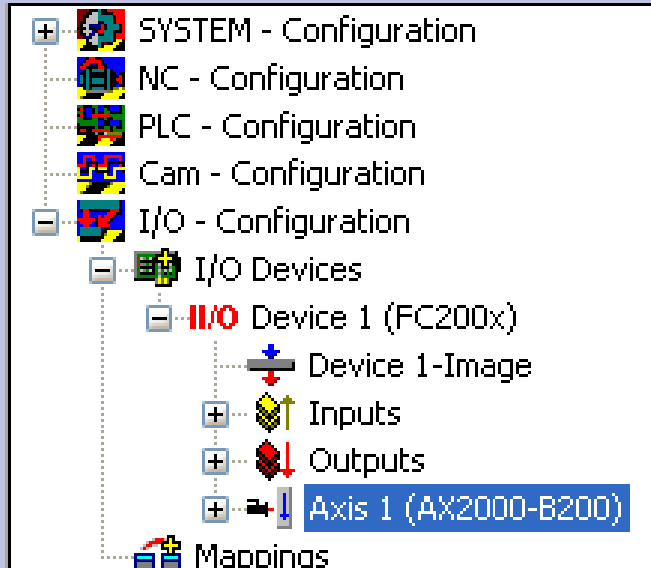


Enter Hardware



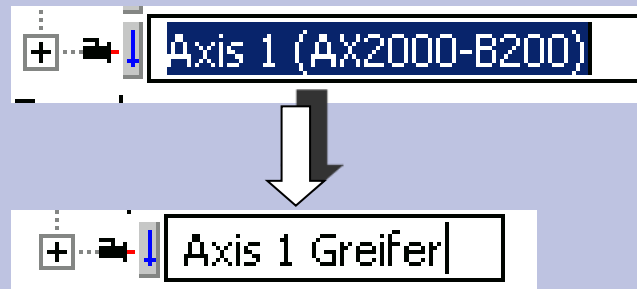


Enter Hardware



Result

Rename?

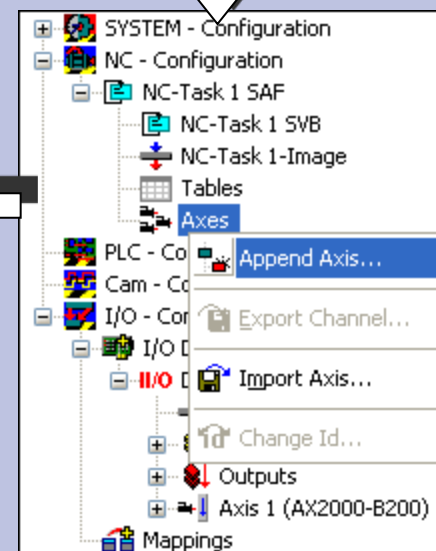
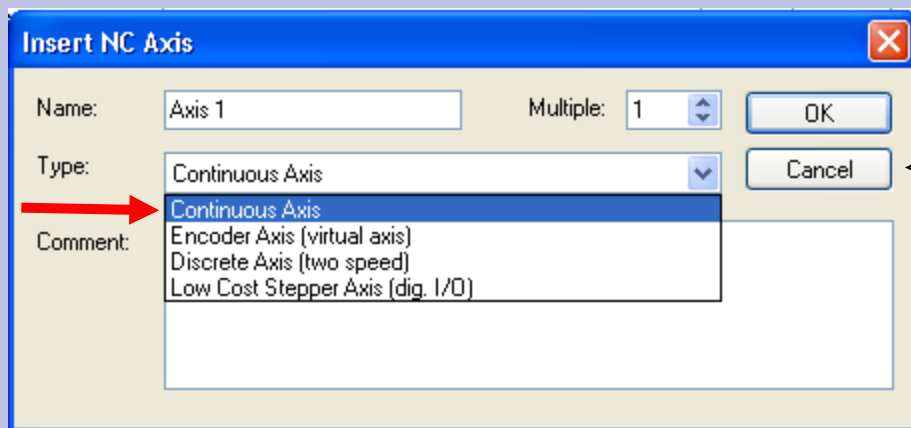
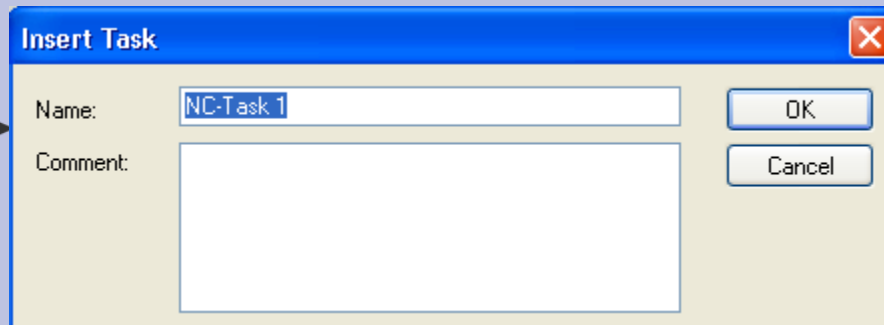
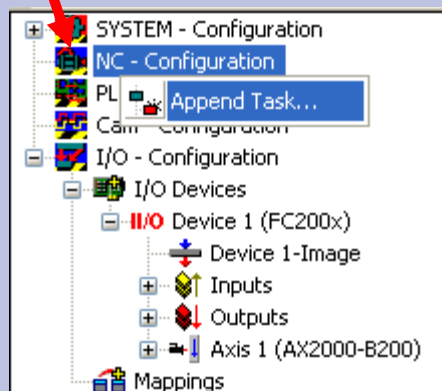


Repeat steps for all further drives



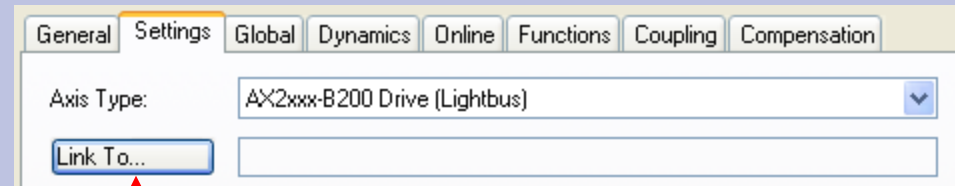
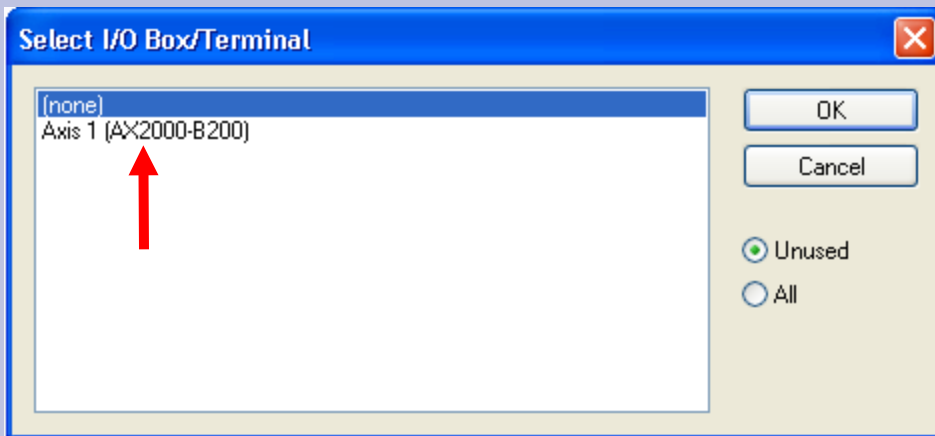
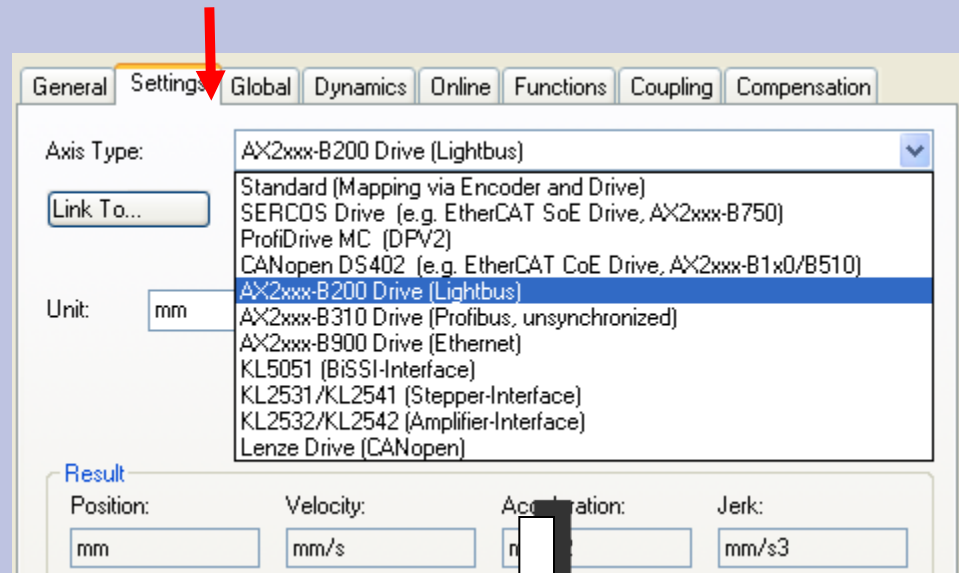
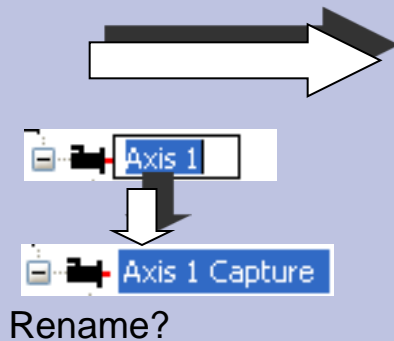
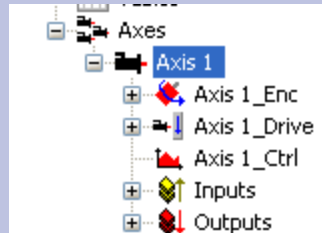
Setting up NC Axes in the System Manager

NC - Configuration



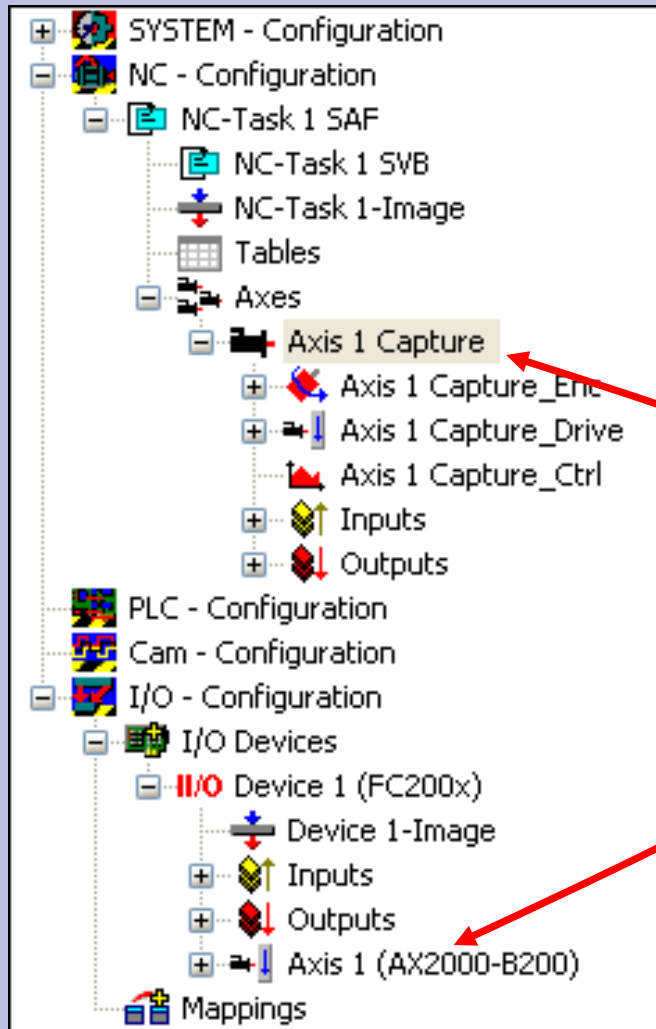


Select and link drive type





Select and link drive type



Связываем входы и выходы TwinCAT NC Controller и сервоусилителя AX 2000



Определение единиц измерения для оси



General **Settings** Global Dynamics Online Functions Coupling Compensation

Axis Type: AX2xxx-B200 Drive (Lightbus) [v]

Link To... Axis 1 (AX2000-B200)

Unit: [mm] [v]
mm
m
°
Grad

Display (Only)

Position: µm Modulo

Velocity: mm/min

Result

Position: [mm] Velocity: [mm/s] Acceleration: [mm/s²] Jerk: [mm/s³]



Параметры энкодера. Коэффициент масштабирования (Scaling factor)

Translation of the collected actual position value in the way unit

$$ScalingFactor = \frac{milageWay}{NumberIncrements}$$

Example :

$$ScalingFactor = \frac{1mm}{65535inc} = 1,52590e-5 \frac{mm}{inc}$$

Axis 1 Capture_Enc

General | **NC-Encoder** | **Global** | Incremental | Online

ENCODER-Mode	E 'POSVELO'
Invert Encoder Counting Direction	B FALSE
Scaling Factor	* F 0.0000152590219
Position Bias	F 0.0 mm
Modulo Factor (e.g. 360.0°)	F 360.0 mm
- Tolerance Window for Modulo Start	F 0.0 mm
ENABLE: Min Soft Position Limit	B FALSE
- Software Position Limit Min	F 0.0
ENABLE: Max Soft Position Limit	B FALSE

Decimal point necessary

Download

Write online to NC

Persistent Changes

Changes are temporary and will lost after TwinCAT restart!

To save changes, the configuration must be saved in the registry.

Do not show dialog again

OK

Save now

Can be taken in Registry



Further Encoder parameter (Notice)

General	NC-Encoder	Global	Incremental	Online
ENCODER-Mode		E	'POSVELO'	
Invert Encoder Counting Direction		B	FALSE	
Scaling Factor	*	F	0.0000152590219 mm/INC	
Position Bias		F	0.0 mm	
Modulo Factor (e.g. 360.0°)		F	360.0 mm	
- Tolerance Window for Modulo Start		F	0.0 mm	
ENABLE: Min Soft Position Limit		B	FALSE	
- Software Position Limit Min		F	0.0 mm	
ENABLE: Max Soft Position Limit		B	FALSE	
- Software Position Limit Max		F	0.0 mm	
Filter Time for Actual Position (P-T1)		F	0.0 s	
Filter Time for Actual Velocity (P-T1)		F	0.01 s	
Filter Time for Actual Acceleration (P-T1)		F	0.1 s	
Encoder Mask (Maximal Value)	r	D	0x0000FFFF	
ENABLE: Actual Position Correction		B	FALSE	
Filter Time Actual Position Correction (P-T1)		F	0.0 s	



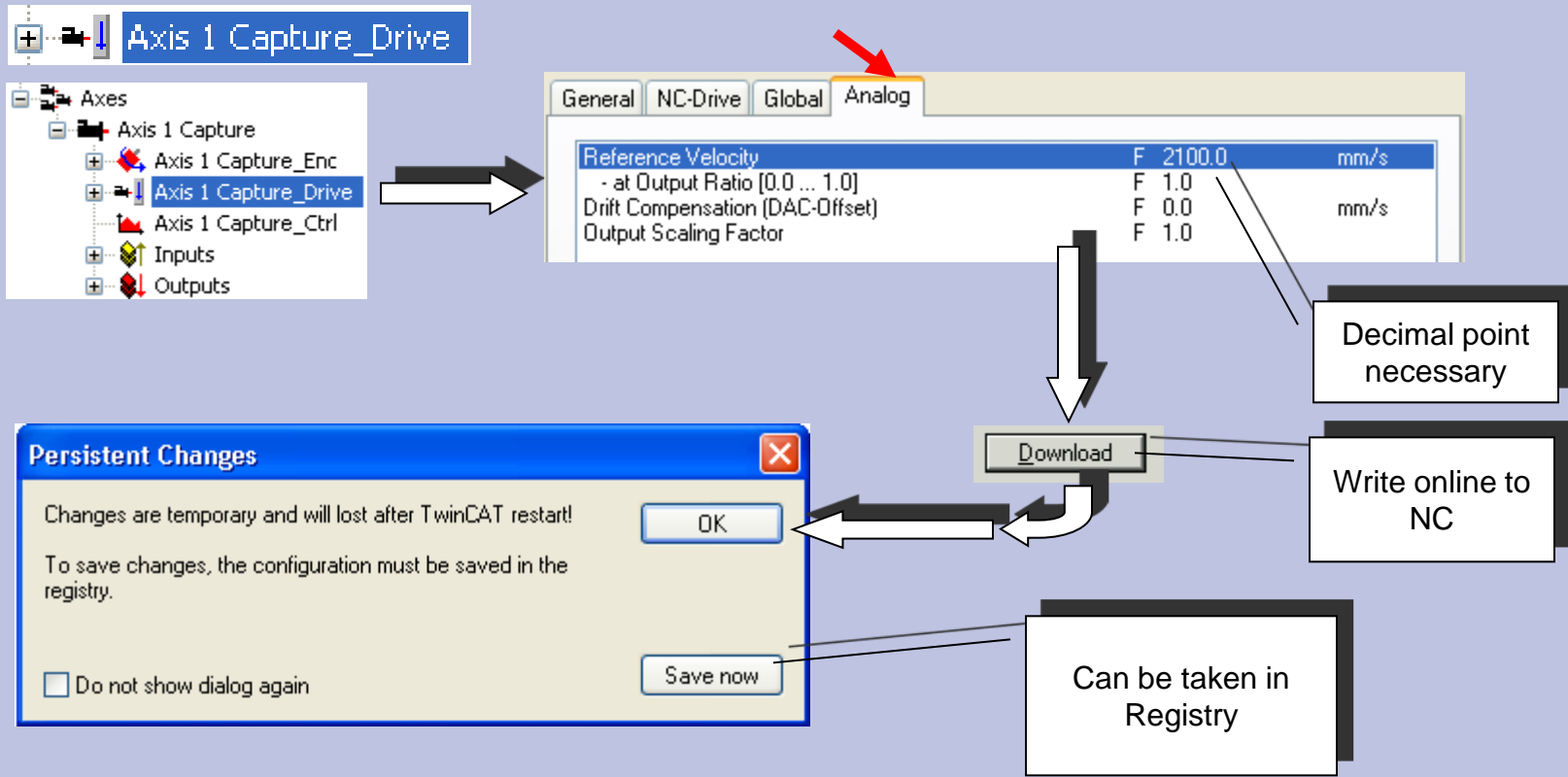
Drive parameter reference velocity

Translation of the max. rotation speed of the drive to a velocity

$$Reference\ velocity = \max\ Rotations\ speed * \frac{Way}{Rotation}$$

Example:

$$Reference\ Velocity = \frac{3000U}{60s} * \frac{1mm}{U} = 50 \frac{mm}{s}$$





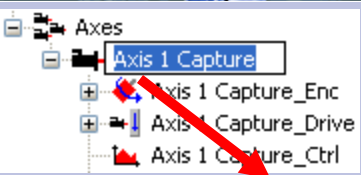
Further Drive parameter (Notice)

General NC-Drive Global Analog

DRIVE-Mode	E 'STANDARD'
Invert Motor Polarity	B FALSE
Minimum Drive Output Limitation [-1.0 ... 1.0]	F -1.0
Maximum Drive Output Limitation [-1.0 ... 1.0]	F 1.0



Global Axis parameter



Parameter	Value	Unit
Maximum Velocity	F 2000.0	mm/s
Manual Velocity (Fast)	F 300.0	mm/s
Manual Velocity (Slow)	F 100.0	mm/s
Calibration Velocity (Forward)	F 30.0	mm/s
Calibration Velocity (Backward)	F 30.0	mm/s
Jog Increment (Forward)	F 5.0	mm
Jog Increment (Backward)	F 5.0	mm
Acceleration	F 1500.0	mm/s ²
Deceleration	F 1500.0	mm/s ²
Jerk	F 2250.0	mm/s ³
Override Type	E Reduced (iterated)	
Setpoint Generator Type	E 7 Phases	
NCI: Rapid Traverse Velocity (GO)	F 2000.0	mm/s
NCI: Velo Jump Factor	F 0.0	
NCI: Tolerance ball auxiliary axis	F 0.0	
NCI: Max. position deviation, aux. axis	F 0.0	
ENABLE: Min Soft Position Limit	B FALSE	
- Software Position Limit Min	F 0.0	mm
ENABLE: Max Soft Position Limit	B FALSE	
- Software Position Limit Max	F 0.0	mm
ENABLE: Position Lag Monitoring	B TRUE	
Maximum Position Lag Value	F 5.0	mm

Допустимая максимальная скорость

Скорость в ручном режиме



Скорость при калибровке

Быстрое перемещение инструмента к позиции обработки (NCI only)

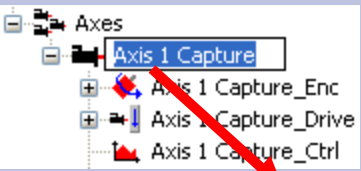
Коэффициент понижения скорости в области сопряжения траекторий (NCI only)

Программное ограничение перемещения (Min, Max)

Мониторинг следующих ошибок:



Global Axis parameter



Parameter	Value	Unit
ENABLE: Min Soft Position Limit	B FALSE	
- Software Position Limit Min	F 0.0	mm
ENABLE: Max Soft Position Limit	B FALSE	
- Software Position Limit Max	F 0.0	mm
ENABLE: Position Lag Monitoring	B TRUE	
- Maximum Position Lag Value	F 5.0	mm
- Maximum Position Lag Filter Time	F 0.02	s
ENABLE: Position Range Monitoring	B TRUE	
- Position Range Window	F 5.0	mm
ENABLE: Target Position Monitoring	B TRUE	
- Target Position Window	F 2.0	mm
- Target Position Monitoring Time	F 0.02	s
ENABLE: In-Target Timeout	B FALSE	
- In-Target Timeout	F 5.0	s
ENABLE: Motion Monitoring	B FALSE	
- Motion Monitoring Window	F 0.0	mm
- Motion Monitoring Time	F 0.1	s
Dead Time Compensation (Delay Velo and Position)	F 0.0	s
ENABLE: Backlash Compensation	B FALSE	
- Backlash	F 0.0	mm
ENABLE: Data Persistence	r B FALSE	

Мониторинг следующих ошибок:

Расхождение актуальной и заданной позиции, временной фильтр ошибки
Для сообщения в ПЛК „Axis in target position“ (Ось в заданном диапазоне)

Контроль текущей позиции при перемещении (NCI only)

Контроль заданной позиции из G-кодов (NCI only)

Оси не пришли в заданную позицию за данное время – Error channel

Время задержки компенсации скорости и позиции

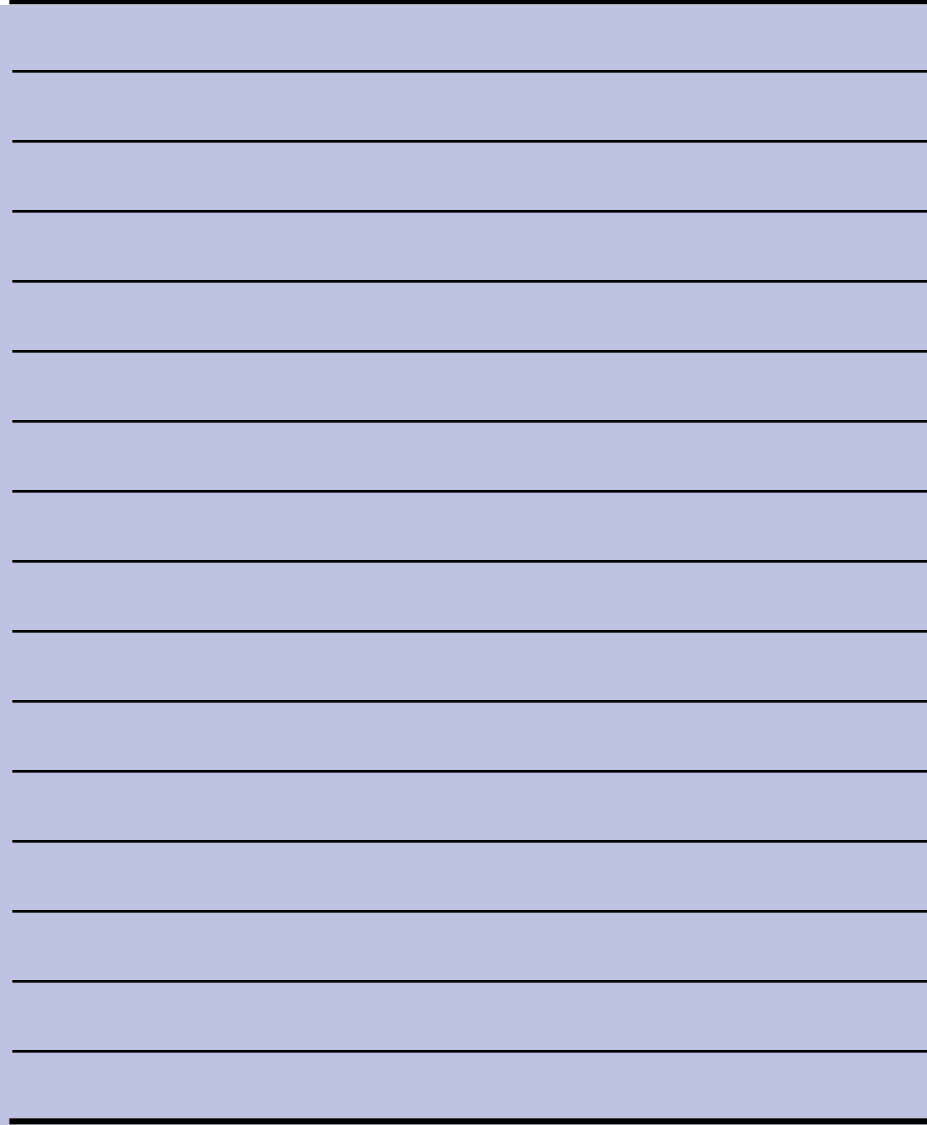


Global Axis parameter (Notice)



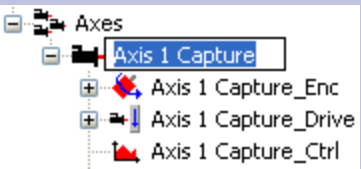
General Settings **Global** Dynamics Online Functions Coupling Compensation

Maximum Velocity	F	2000.0	mm/s
Manual Velocity (Fast)	F	300.0	mm/s
Manual Velocity (Slow)	F	100.0	mm/s
Calibration Velocity (Forward)	F	30.0	mm/s
Calibration Velocity (Backward)	F	30.0	mm/s
Jog Increment (Forward)	F	5.0	mm
Jog Increment (Backward)	F	5.0	mm
Acceleration	F	1500.0	mm/s ²
Deceleration	F	1500.0	mm/s ²
Jerk	F	2250.0	mm/s ³
Override Type	E	Reduced (iterated)	
Setpoint Generator Type	r E	7 Phases	
NCI: Rapid Traverse Velocity (G0)	F	2000.0	mm/s
NCI: Velo Jump Factor	F	0.0	
NCI: Tolerance ball auxiliary axis	F	0.0	
NCI: Max. position deviation, aux. axis	F	0.0	
ENABLE: Min Soft Position Limit	B	FALSE	
- Software Position Limit Min	F	0.0	mm
ENABLE: Max Soft Position Limit	B	FALSE	
- Software Position Limit Max	F	0.0	mm
ENABLE: Position Lag Monitoring	B	TRUE	
Maximum Position Lag Value	F	5.0	---





Dynamic



General Settings Global **Dynamics** Online Functions Coupling Compensation

Indirect by Acceleration Time

Maximum Velocity (V_{max}): mm/s


Acceleration Time: s


Deceleration Time: as above s

smooth stiff

Acceleration Characteristic:

Deceleration Characteristic:

$a(t)$: 

$v(t)$: 

Direct

Acceleration: mm/s²

Deceleration: as above mm/s²

Jerk: mm/s³

Download Upload

Взаимосвязь при
изменении
параметров

Effects see [Set value profiles](#)



Starting NC Axes from the PLC

- Part I General
- Overview
- Axis types
- Functional principle
- Referencing
- Motion Control Function Blocks

- Teil II Practical Part:
- Setting up NC axes in the System Manager
 - Starting NC axes from the PLC

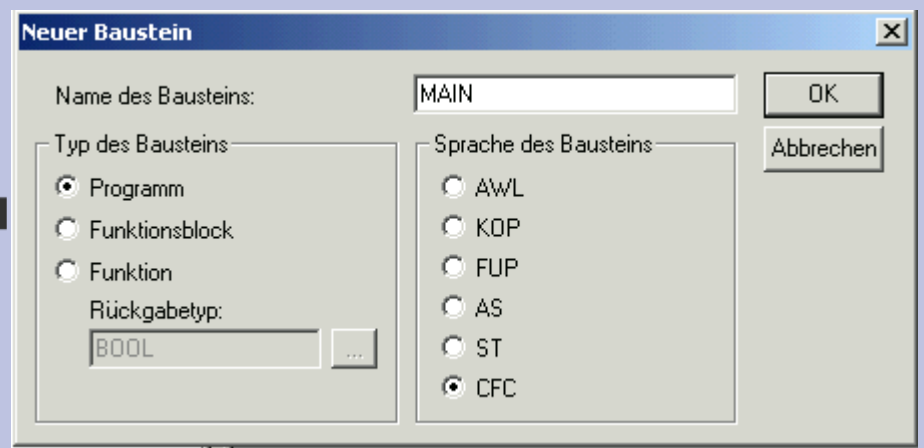
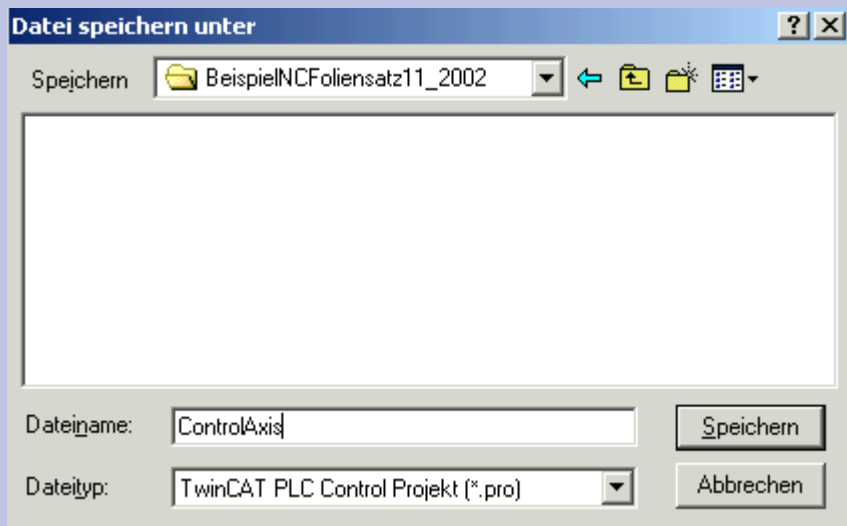
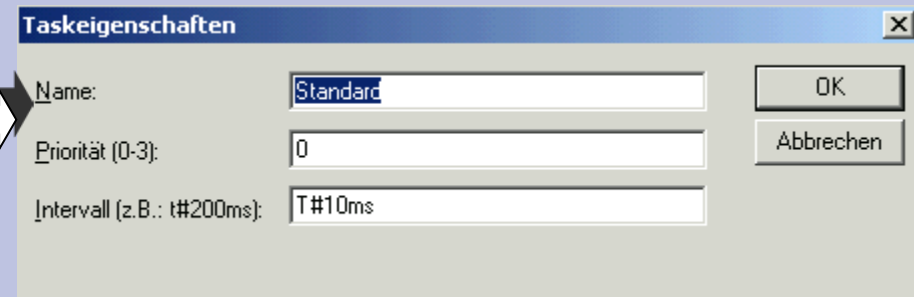
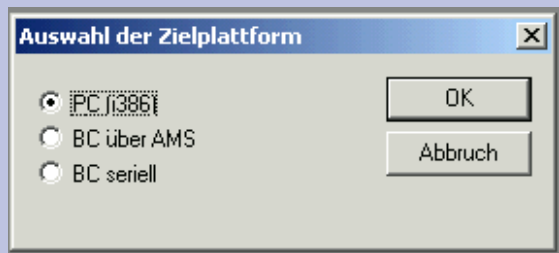
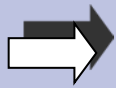
Example: A small project for starting an single axis should be created with the help of the MC Library

Notes:

- The control of the enable signals (hardware) is not treated in this example.
- The programming mode corresponds in this example to the classical PLC programming, that means global variables for the inputs and outputs and referencing in the POU's.
- An alternative is the creation of FBs, which work internally with not total located variables for the axis interface.(VAR_CONFIG)

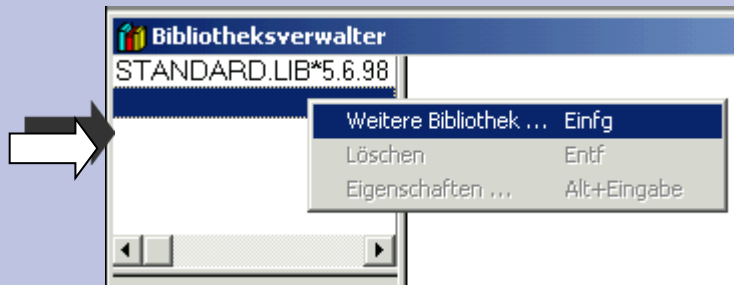
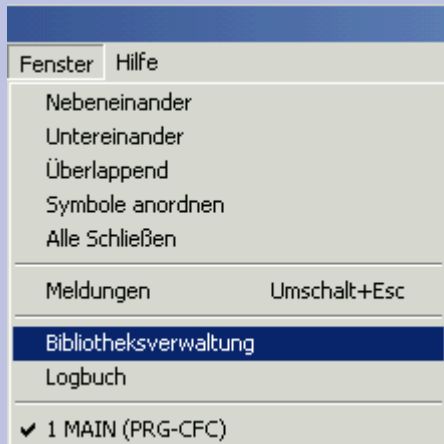


Creating a PLC Project

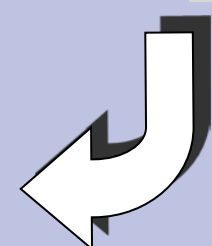
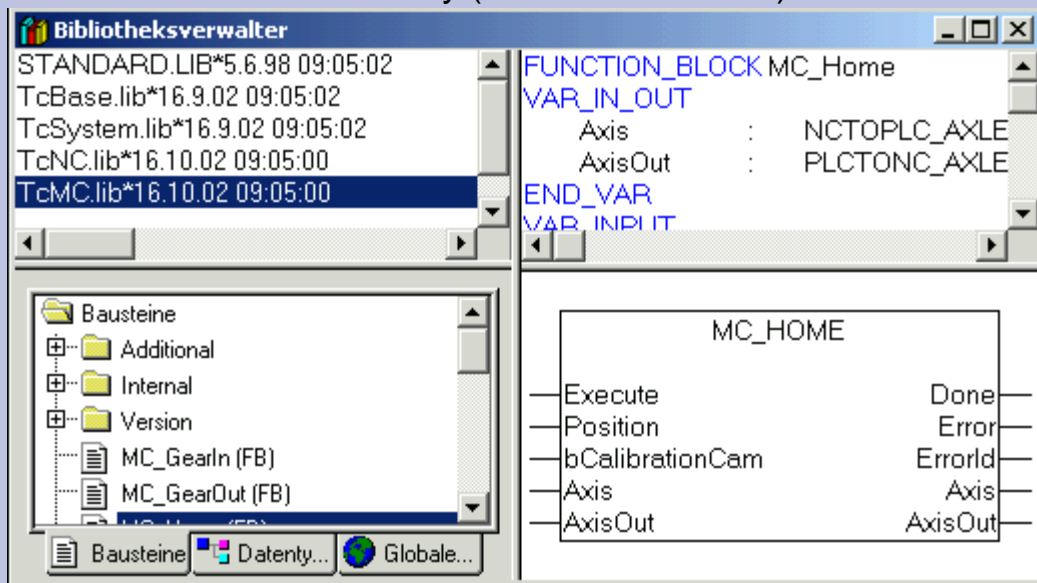




Inserting TcMC Library



Further required libraries will be inserted automatically (from TwinCAT 2.8)





Creating Input / Output variable between NC and PLC



```

Globale_Variablen
0001 VAR_GLOBAL
0002 (*Axisinterface*)
0003 Axis1GreiferPlcToNc AT%QB1000 : PLCTONC_AXLESTRUCT;
0004 Axis1GreiferNcToPlc AT%IB1000 : NCTOPLC_AXLESTRUCT;
0005
0006
    
```

To consider:

1 Variable occupies 128 Byte. Thus the next free address to start is IB/QB 1128.

In addition the possibility of auto addressing can be used.

Axis1GreiferPlcToNc **AT%QB*** : PLCTONC_AXLESTRUCT;

```

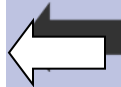
Globale_Variablen
0001 VAR_GLOBAL
0002 (*Axisinterface*)
0003 Axis1GreiferPlcToNc AT%QB1000 : PLCTONC
0004 Axis1GreiferNcToPlc AT%IB1000 : NCTOPLC
0005
0006
0007 (*I/O for control *)
0008 genRelease AT%IX0.0 : BOOL:
0009 RequestHoming AT%IX0.1 : BOOL:
0010 RequestSequence AT%IX0.2 : BOOL:
0011 SwitchReferenceCamAxis1 AT%IX0.3 : BOOL:
0012
    
```

Control inputs.

Linking with hardware,

„ Writing values“ in PLC Control, or

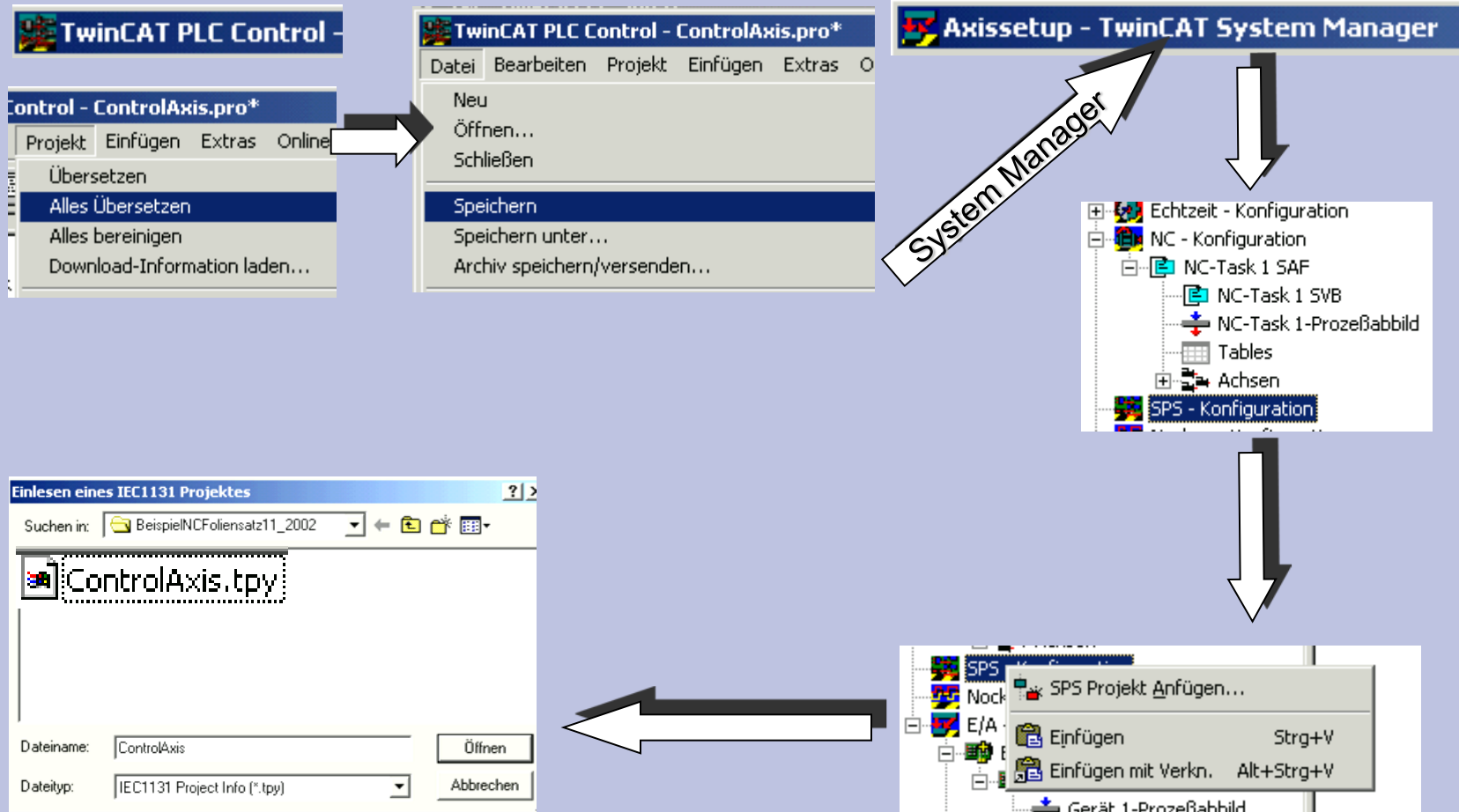
Control with a small VB / VC++



It's understood, that at direct commissioning at a movement, the safety precautions are to be considered



Linking Input / Output variable between NC and PLC



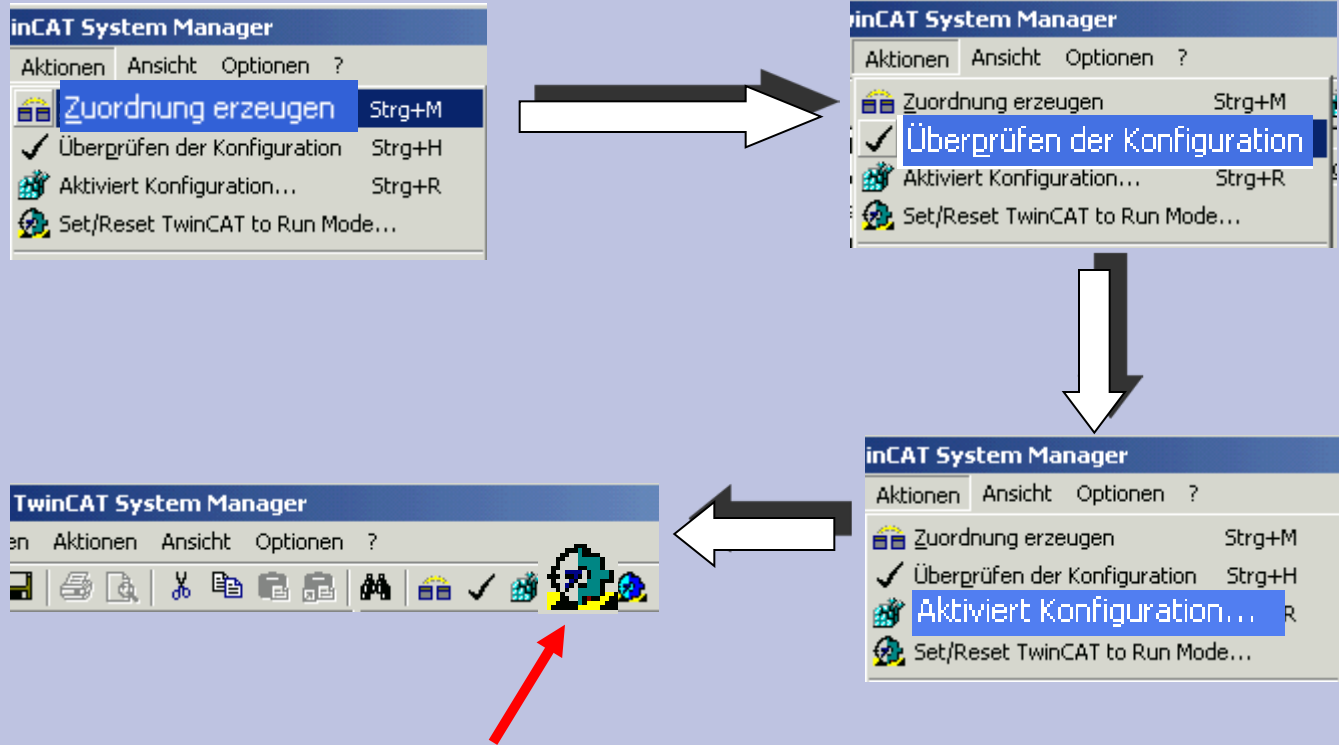


Linking Input / Output variable between NC and PLC

Axissetup - TwinCAT System Manager



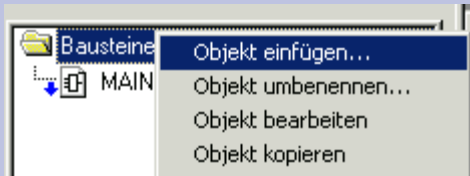
Linking further control inputs and writing configuration in registry



System can be started here.



Programming axis enables MC_POWER



Neuer Baustein

Name des Bausteins: OK

Typ des Bausteins:

Programm

Funktionsblock

Funktion

Rückgabtyp: Abbrechen

Sprache des Bausteins:

AWL

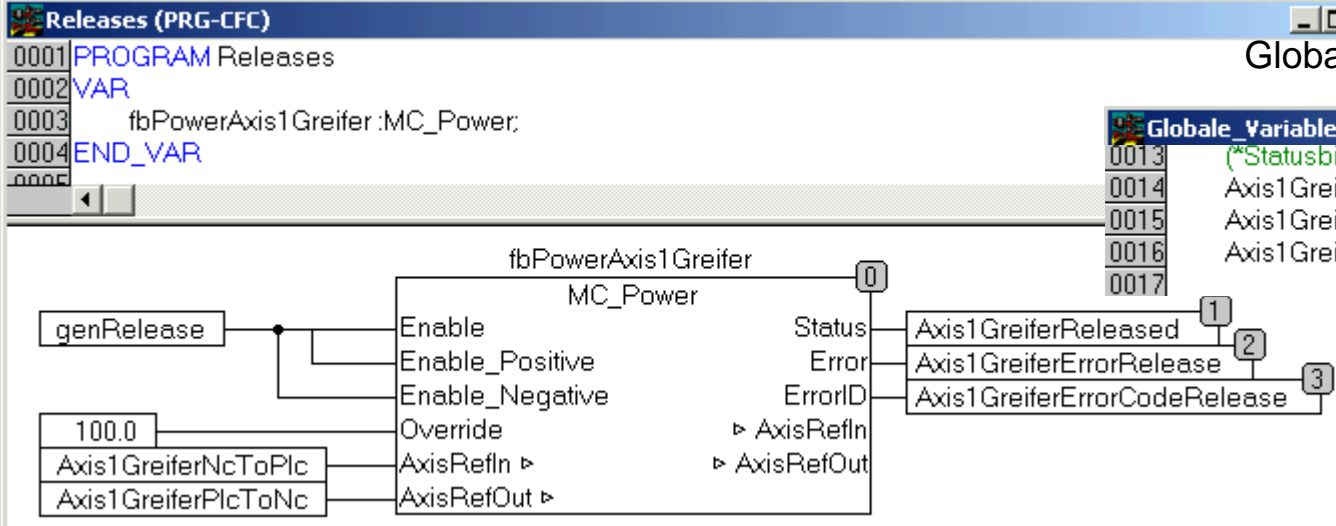
KOP

FUP

AS

SI

CFC



Global Status Variable for MC_Power

Globale Variablen	
0013	(*Statusbits*)
0014	Axis1GreiferReleased : BOOL;
0015	Axis1GreiferErrorRelease : BOOL;
0016	Axis1GreiferErrorCodeRelease : UDINT;
0017	





Calling axis enables

Direct in Main

```

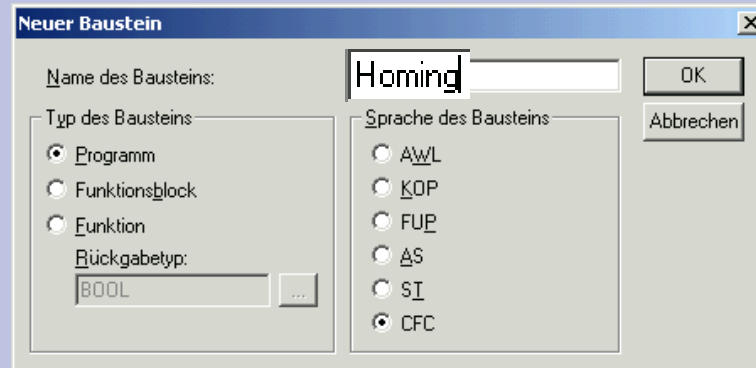
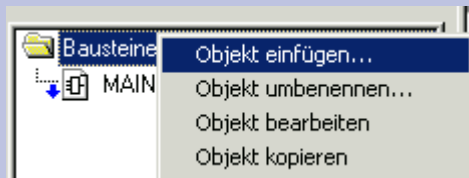
MAIN (PRG-CFC)
0001 PROGRAM MAIN
0002 VAR
0003 END_VAR
0004
    
```

Or via Taskconfiguration

USE ONLY ONE POSSIBILITY!



Instantiate and call MC Home block



Global Status Variable for MC_Home

Homing (PRG-CFC)

```

0001 PROGRAM Homing
0002 VAR
0003     fbHomingAxis1Greifer :MC_Home;
0004 END_VAR
                    
```

Globale_Variablen

```

0016 Axis1GreiferErrorCodeRelease : UDINT;
0017
0018 Axis1GreiferHomingReady : BOOL;
0019 Axis1GreiferErrorHoming : BOOL;
0020 Axis1GreiferErrorCodeHoming : UDINT;
0021
                    
```



Calling Homing

Direct in Main

MAIN (PRG-CFC)

```

0001 PROGRAM MAIN
0002 VAR
0003 END_VAR
0004
    
```

USE ONLY ONE POSSIBILITY!

Or via Taskconfiguration

Ressourcen

- Bibliothek STANDARD.LIB*5.6.98 09:05:02:
- Bibliothek TcMC.lib*16.10.02 09:05:00: Glob
- Bibliothek TcNC.lib*16.10.02 09:05:00: Glob
- Bibliothek TcSystem.lib*16.9.02 09:05:02: G
- Globale Variablen
 - Globale_Variablen
 - Variable_Configuration (VAR_CONFIG)
- Steuerungskonfiguration
- Taskkonfiguration**
- Traceaufzeichnung
- Watch- und Rezepturverwalter

Bausteine | Datentypen | Ressourcen

Taskkonfiguration

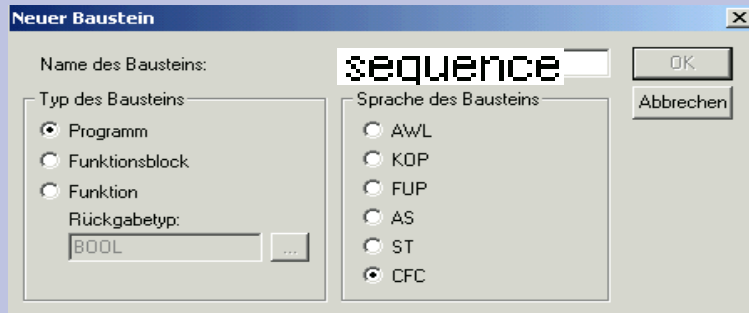
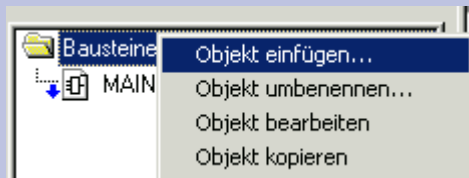
- Taskkonfiguration
 - Standard (PRIORITY := 0, INTERVAL := T#10ms)
 - Releases
 - Homing
 - MAIN

Taskkonfiguration

- Taskkonfiguration
 - Standard (PRIORITY := 0, INTERVAL := T#10ms)
 - MAIN
 - Programmaufruf einfügen
 - Unterelement anhängen
 - Eigenschaften...
 - Ausschneiden Strg+X
 - Kopieren Strg+C
 - Einfügen Strg+V
 - Löschen Entf
 - Debug Task festlegen



Instantiate and call MC MoveAbsolute block

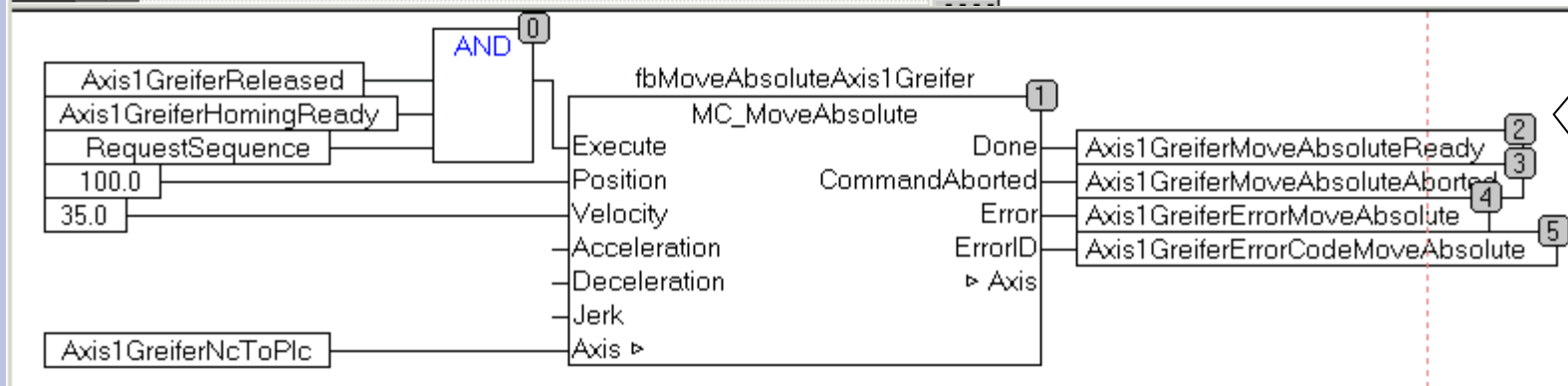


Global Status Variable for MC_MoveAbsolute

```

sequence (PRG-CFC)
0001 PROGRAM sequence
0002 VAR
0003     fbMoveAbsoluteAxis1Greifer: MC_MoveAbsolute;
0004 END_VAR
0005
    
```

Globale_Variablen		
0001	VAR_GLOBAL	
0020	Axis1 GreiferErrorCodeHoming:	UDINT;
0021		
0022	Axis1 GreiferMoveAbsoluteReady :	BOOL;
0023	Axis1 GreiferMoveAbsoluteAborted :	BOOL;
0024	Axis1 GreiferErrorMoveAbsolute :	BOOL;
0025	Axis1 GreiferErrorCodeMoveAbsolute :	UDINT;





Calling Sequence

Direct in Main

MAIN (PRG-CFC)

```

0001 PROGRAM MAIN
0002 VAR
0003 END_VAR
0004

```

Or via Taskconfiguration

Taskkonfiguration

- Taskkonfiguration
 - Standard (PRIORITY := 0, INTERVAL := T#10ms)
 - MAIN
 - Programmaufruf einfügen**
 - Unterelement anhängen
 - Eigenschaften...
 - Ausschneiden Strg+X
 - Kopieren Strg+C
 - Einfügen Strg+V
 - Löschen Entf
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USE ONLY ONE POSSIBILITY!

Taskkonfiguration

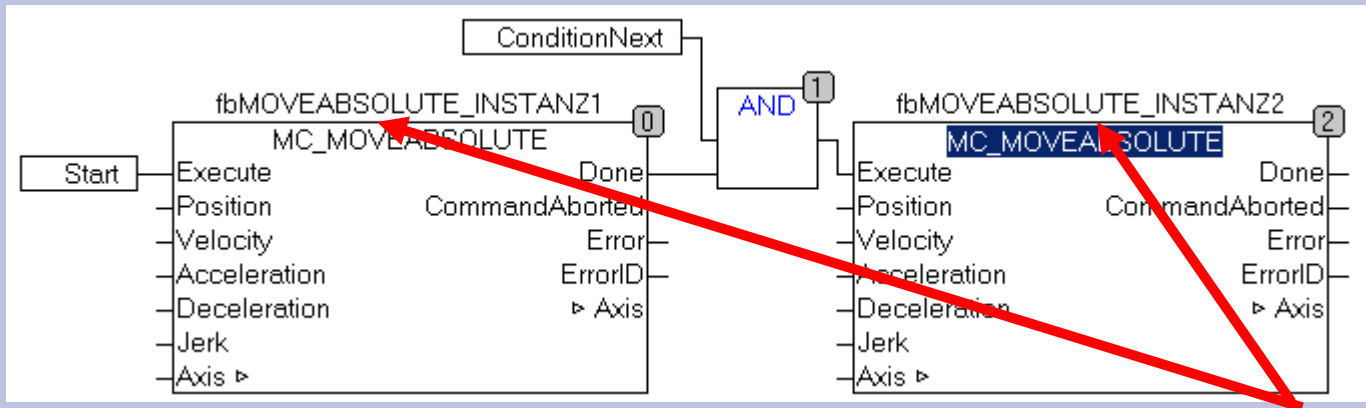
- Taskkonfiguration
 - Standard (PRIORITY := 0, INTERVAL := T#10ms)
 - Releases
 - Homing
 - sequence



How can a flow be realised??

If the application requires flows, the MC blocks are normally used in sequence cascades. The MC_XXXXX blocks are suited well for the use in Sequential Function Chart or in a case instruction in ST.

At graphic languages like CFC is in the first attempt a so-called cascading possible:



This acts reasonable, if for each command a new instance of the MC block is created

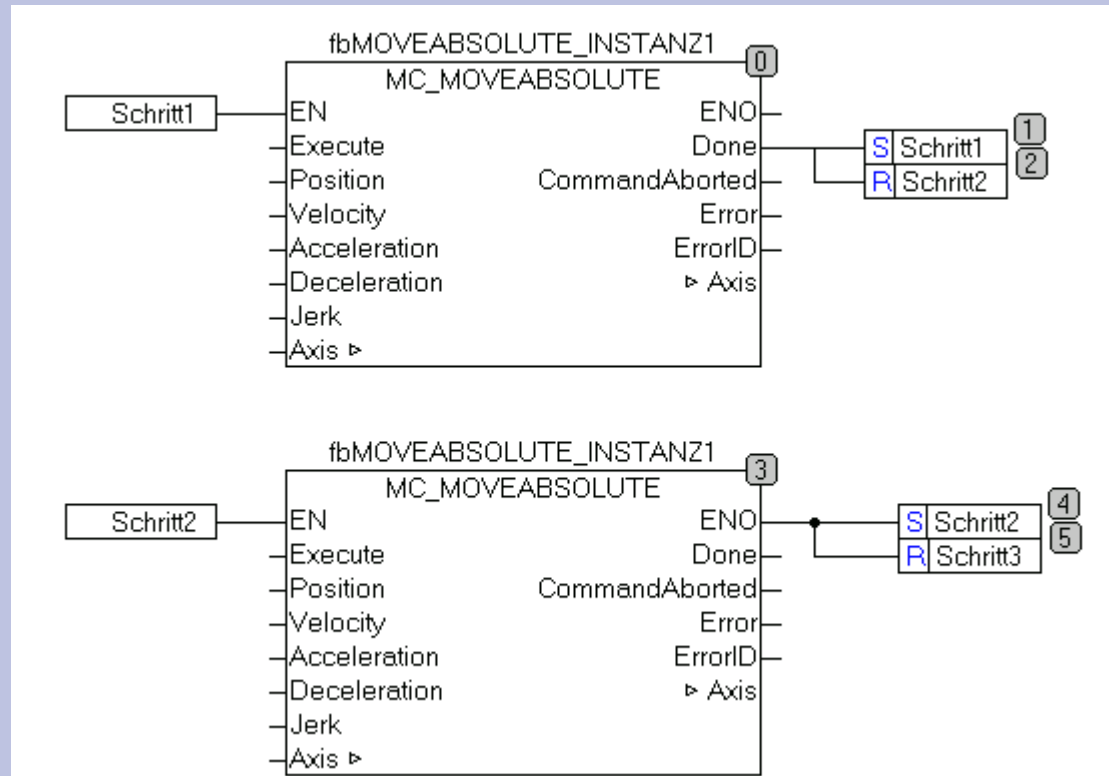


How can a flow be realised?

A further possibility is the using of the same instance with „EN” inputs which are controlled by step reminder.

To consider:
The Fb accepts the next „execute” only, if there´s a flank at the input.

In addition
„Disturbances in the flow“ like Command aborted and Error have to be considered.





How can a flow be realised?

PLC Project with „flow in CFC by using the EN inputs



ControlAxis.pro



Axissetup.tsm