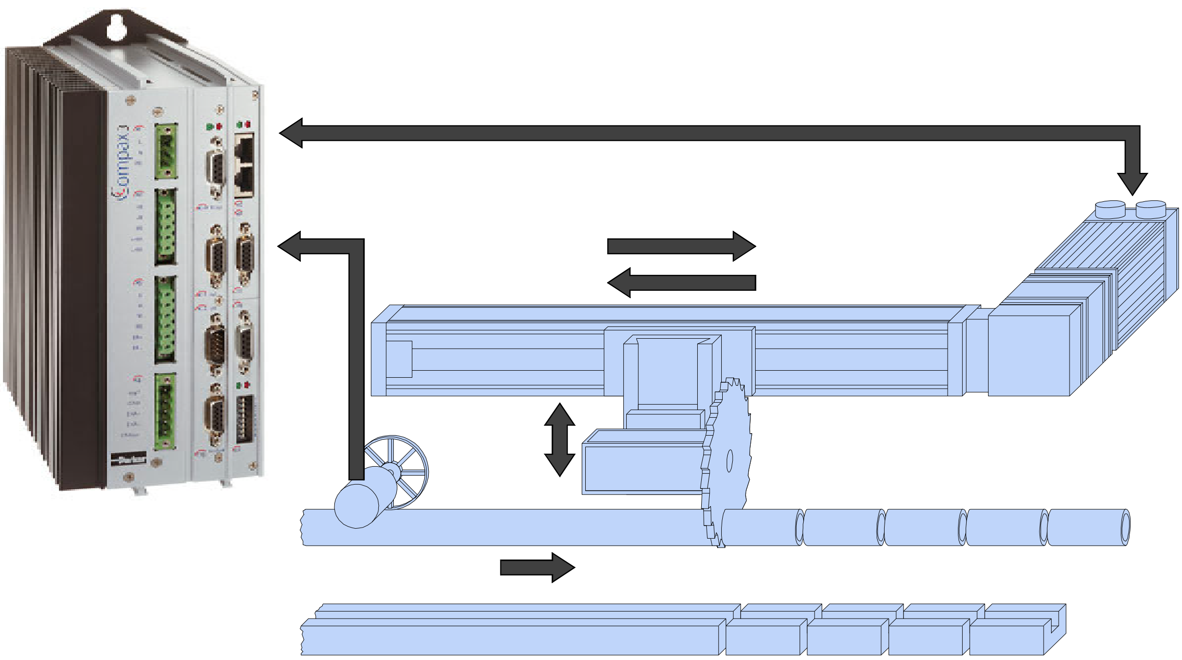
CONTROL TECHNOLOGY FROM PARKER

C3 Ixx T40
Application Note

Cut On Fly



C3T40_A1003_eng

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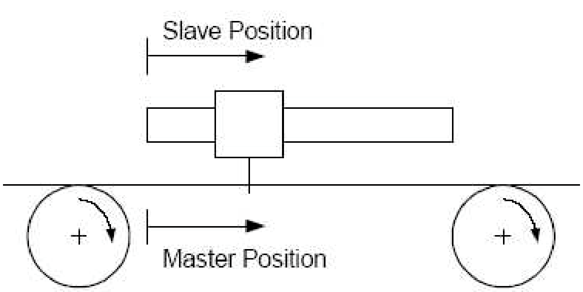
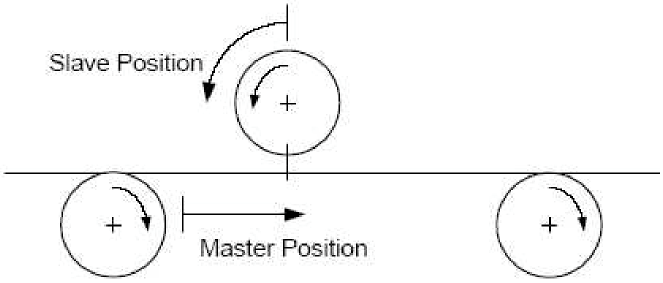
1. General

This manual describes the IEC program of an application example for a cutting on the fly application which consists of several CAM standard function modules within a "CutOnFly" function module, which performs the basic tasks of the synchronous motion.

This application example is especially suitable for the Start/Stop operation of a synchronously following tool (flying shear) or of a rotating cutter which comes to a standstill cyclically at the start position.



Flying Shear



Rotating Cutter

For rotating cutters without standstill area, the CAM modules C3_CamIn, C3_CamOut can be used according to the application examples in the manual.

2. Cutting on the fly functions

2.1. Boundary conditions

Synchronization takes place with the aid of a linear speed ramp and rectangular acceleration resulting from quadratic coupling.
Decoupling with return trip is, however, jerk-limited with a stop function and possible positioning to start position.
During configuration, a curve with linear slope must be predefined.
If an asynchronous motor is used, you must especially consider the field weakening operation. This is only possible in part, as the acceleration ramps are not adapted to the field weakening operation.

2.2. Processing on the fly saw / shear / processing

The saw carriage is mounted parallel to the material flow direction. It will be accelerated up to the speed of the processed material and then travels synchronous to the material speed. The relative speed between material and saw carriage adjusts to zero. When the synchronization is reached, it is indicated by the module via a binary output. Now the cutting process will be executed by the movement of the cutting tool rectangularly to the material travel. Synchronous motion is automatically terminated via a predefined synchronous distance and the carriage is braked. Then the carriage returns automatically to its starting position or to any other predefined position. There, the saw waits until the material has traveled the distance according to the cutting length.

2.3. Diagonal-beam saw

The diagonal-beam saw is a special version of the cutting on the fly saw. Here the guidance of the saw (linear actuator) is placed at a fixed angle above the processed material. The saw blade is rectangular to the material flow direction. When the saw moves, it results in a movement in the material flow direction dependent on the angle between the path of the saw and the material.

The controller adjusts the speed of the saw in relation to the angle of beam thus it results in a synchronism between saw blade and material. The relative speed is zero. At the end of the cutting process the saw will be lifted and moved to a waiting position.

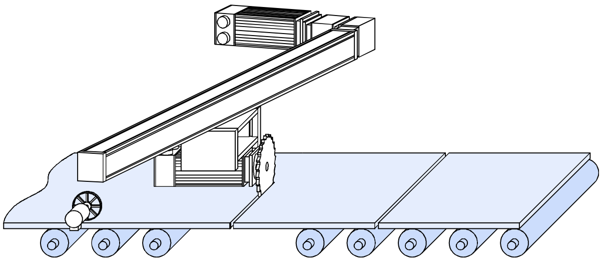


Figure 1: Diagonal-beam sawing

The travel data are **not** influenced by the angle of beam.

2.4. Mark (label) related processing

In some applications, the measurement of the material feed forward is not required to operate continuously but is dependent on a mark (label) fixed on the material. The measurement of the length then begins when the label is detected and transmitted to the module via an input.

2.5. Waste length

With increasing material speed, longer processing time or reduced cutting length, the time of the drive in waiting position gets shorter. If the waiting time approaches zero, the control changes over to the double product length, the so-called "waste length". This situation is indicated by COMPAX via an output.

2.6. Manual cut

During manual cutting, the synchronization is started immediately from the waiting position. The predefined length is not respected.

2.7. Head cut – first processing

The first synchronization cycle after a program start is treated specially.

2.8. Material simulation

During the start up situation, when in general material is not yet available, the material speed can be simulated via the virtual master as shown in the application example.

2.8.1. Master connection

Suitable as master signals are:
Encoder A/B or step/direction
Virtual Master
HEDA
CAN

3. Motion functions

3.1. Synchronization with / without automatic return

3.1.1. Parameters

Signal	Description
Count	Enable input for position of selected master source. This begins (if warm start is not activated) at the rising edge and ends at the end of the master cycle where the input turns to False.
Start	From the rising edge on, a complete synchronization sequence is immediately executed from an idle position of the drive. This may also include the return trip (formerly: WAIT POSA or WAIT POSR). This first synchronization sequence represents the head cut. The falling edge initiates the termination of the synchronized motion with Stop. This may be followed by a POSA on the start position, depending on the ReturnMode.
ProdLength	Without mark reference: Length of material during cutting with mark reference: maximum product length if the mark is not detected.
SyncStart	synchronization start path
SyncDist	Synchronous distance from the beginning of the synchronous motion to the independent Stop / return trip. This is shortened by a manual Stop.
Target	Target position with reference to start position.
CutDistance	Processing distance
ReturnMode	TRUE: Synchronization without return trip FALSE: Synchronization with return trip
MoveVelocity	Speed for travel to target position
Accel	Acceleration during return trip
Decel	Deceleration on Stop and return trip
AccelJerk	Jerk with acceleration during return trip
DecelJerk	Jerk with deceleration during return trip
InSync	binary output "synchronism reached"
StartPos	binary output "start position reached"

3.1.2. Procedure of a synchronization process

Acceleration to material speed

During active mark reference, the drive is stationary still in the idle position until the material length necessary for the processing distance **CutDistance** has been traveled. The starting time = coupling position is calculated by the firmware.
If the mark reference is inactive, a waiting distance where the drive remains still will automatically result from the product length **ProdLength** as well as the synchronous and return movement, before the coupling position is reached and the Slave begins the synchronization process.

Acceleration to material speed takes place via a quadratic coupling function and predefinition of a fixed acceleration distance in **SyncStart**. This will be covered by the control during the acceleration stage.

Features:

- The acceleration distance for synchronization is constant.
- The needed acceleration torque increases with the material speed.
- The user may, if required, keep the acceleration torque constant by scaling the synchronization start path with the master speed.

Start of processing

Processing can be triggered with the binary output **InSync**.
The **InSync** status output is set, if the drive is synchronous to the material, i.e. the synchronization start path has been traveled.

The user can delay the start of processing with the aid of a switching cam (formerly synchronous comparator, P33) in order to compensate the detrimental effect of an overshoot of the drive.

Processing time
The synchronous motion will be completed as follows:
- with a negative edge at the binary input **Start** or
- if the synchronous distance **SyncDist** has been traveled.

End of processing with optional return trip
The behaviour of COMPAX at the end of processing can be influenced with the **ReturnMode**:

ReturnMode = TRUE: COMPAX stops after the end of processing. The user must extend the application example by a MC_MoveAbsolute module and drive directly to the desired start position.
ReturnMode = FALSE: After Stop,COMPAX will move to the start position **Target** with the aid of **Velocity, Accel, Decel, AccelJerk and DecelJerk.**

Travel Limit supervision
Note: The monitoring of software end limits is independent of the synchrotact functions.

Idle position reached
Synchronous motion is terminated at the idle or start position defined via **Target**. Output "start position reached" **StartPos** goes to TRUE.

3.2. Correction of saw blade

Signal	Description
SawCorr	In SawCorr, the reduction of length for a "cut on the fly saw" is entered to compensate for (blade thickness). This is added to product length and processing distance;

3.3. Mark related synchronization

Signal	Description
LabelMode	FALSE: Without mark reference TRUE: with mark reference.
Label	The trigger input for the label signal must refer directly to the hardware input (MC_TouchProbe.TriggerInput:= TouchProbeInput*n*
LabelWindow	Ignore window after offset correction, is used for hiding multiple or bouncing labels.
SensorDist	Position of the label sensor in relation to the machine zero point (formerly: P31)
CutDistance	Processing distance with active label reference
LabelError	Label (mark) error

Mark-related synchronization via mark input is switched on with the binary input **LabelMode**. The label triggers the C3_TouchProbe module and latches the current master position. After reaching the original position, the master position is manipulated with the aid of the Offset so that the processing distance **CutDistance** is reached during the next synchronous motion.
From the master position correction on, an ignore window **LabelWindow** begins. Only if the master position has traveled further by the predefined distance, the C3_TouchProbe is activated again and the new label is accepted. This helps eliminate signal bouncing or multiple labels.

In this operating mode, the **ProdLength** variable is used as maximum product length in case a label is not detected.

With activated label reference, please consider:

- The **SensorDist** variable specifies the position of the label sensor with reference to the machine zero point of the linear actuator.

parallel processing

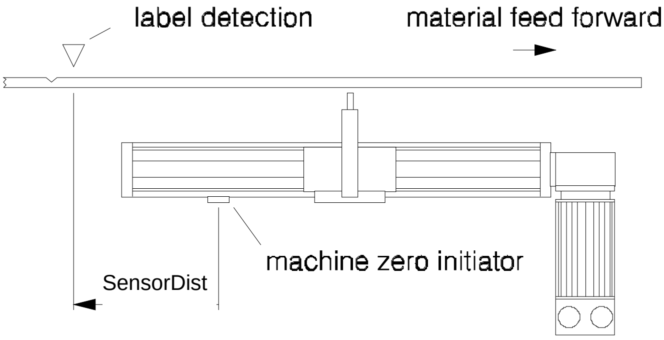


Figure 2: Sensor distance for parallel processing

Diagonal-beam sawing

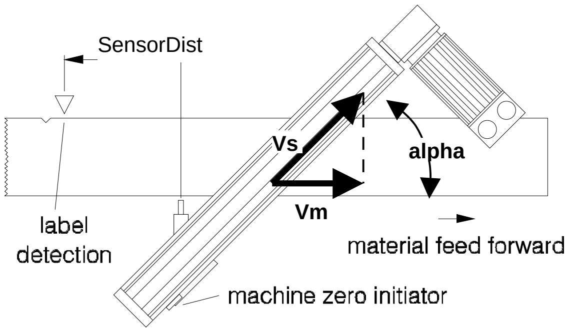


Figure 3: Sensor ditance for diagonal beam saw

If a label is detected too early so that the corrected master position would be above the coupling position, the correction is not made and a label error **LabelError** is reported. In this case the maximum product length **ProdLength** becomes effective.

The label reference is realized with a small sequence chain.
Step 1: Activate MC_TouchProbe and wait for label;
if available, accept latched master position
Step 2: offset correction with number range monitoring
Step 3: latch corrected master position
Step 4: Wait for ignore window, then back to step 1

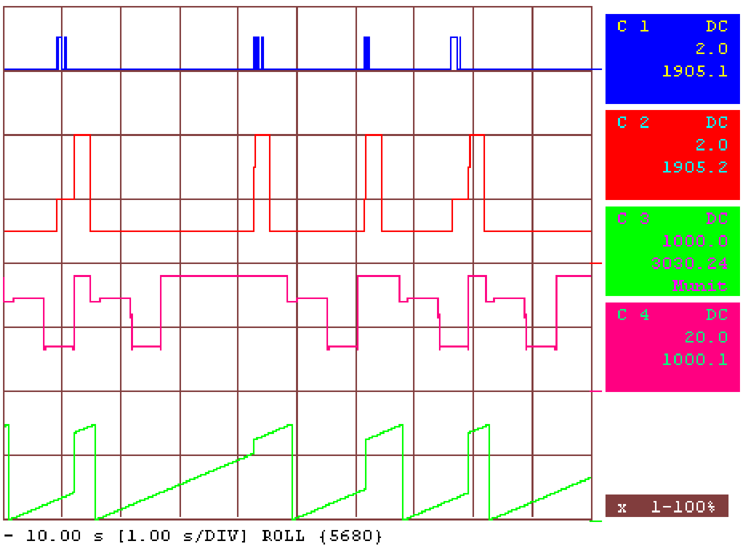


Figure 4: Timing diagram for mark reference

blue: Label signal (first edge counts)
red: Step 1...4
green: Master position (here: range of numbers 0...1500mm) with offset correction
magenta: DeviceState

3.4. Diagonal-beam sawing

Signal	Description
BeamAngle	Diagnonal-beam angle between 0 ...80°

Note the following points:

- Standard value of the angle of diagonal beam in variable **BeamAngle** (acute angle between the linear actuator and the material movement).
  Range: 0...80 degrees.

Given: Master speed Vm in product direction
Diagnonal-beam angle alpha = 0 ...80°

Therefore the slave speed **Vs = Vm/cos(alpha)**

The relation 1/cos(alpha) enters the position of selected master source as global scaling factor for the master speed.

3.5. Waste length

Signal	Description
LenOK	Output processing distance ok
LenWaste	Output waste length

It applies **without label (mark) reference**:
If the return movement takes too long and the internally calculated coupling position is already exceeded on reaching the start position, another product length will be automatically added to the specified product length. This means that the waste length is double the product length. (This is also the waste length known from CPX M/S.)

The status of the device control is verified at the end of the master cycle. If the control is in coupling state, the product length is ok: **LenOK = TRUE** and **LenWaste = FALSE**.
If the device control is in the "waiting for coupling position" state, **LenOK = FALSE** and **LenWaste = TRUE** are reported.

It applies **with label reference**:
If the label is detected too early and a master correction is not performed, a maximum product length results automatically. The LabelError output is set, the LenOK output goes to FALSE.

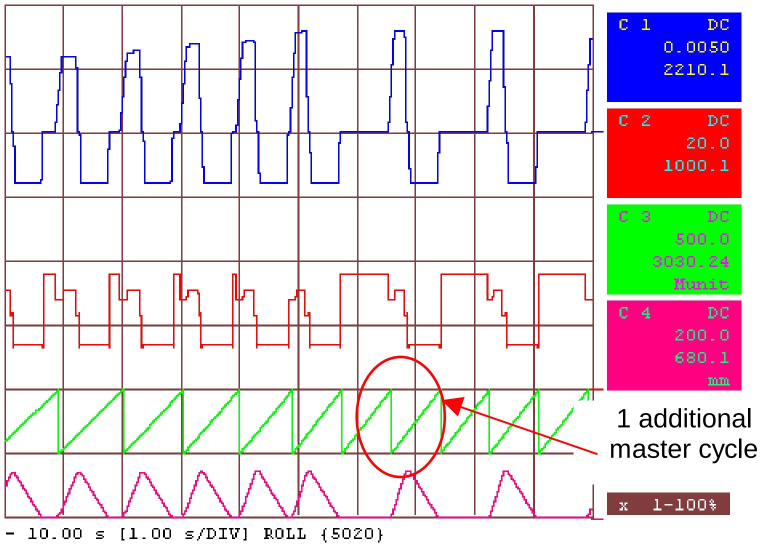


Figure 5: Timing diagram waste length

blue: Slave speed
red: DeviceState
green: Master position (here: Number range 0...500mm)
magenta: Slave setpoint position

3.6. Head cut

Without label reference
The first synchronization request is executed immediately after the position of selected master source enable (if warm start is not activated). As the material length is part of the curve format, any additional cut will be correct (if no waste length results).

With label reference
With label referenced synchronization, already the first synchronization point after start is approached with reference to a label.

3.7. Manual cut

Signal	Description
ManCut	Input: Immediate start of synchronization

After a start, the synchronization can be triggered immediately via the binary input **ManCut**.
Requirements: the synchronization has already been started and the axis is waiting on the start position: DeviceState = 36 (waiting for coupling).
For this, the current master position at the time of rising edge at the ManCut input is set against the coupling position. The difference is added as physical offset in Munits to the master position (CamManipulation.OffsetMasterposition_Units, o3022.6).[1]

[1] Prerequisite is that the curve (=straight line) does not contain too many interpolation points, unless the curve generator will report an error "Interpolation point not found". Typically the minimum number of 18 interpolation points is chosen, normally only 2 interpolation points would be required for a straight line.

3.8. Synchronous stop path

Signal	Description
ScaleRet	=0: Braking and return travel with prespecified Acceleration, Deceleration and Velocity (formerly: P34 = 0) >0: Scaling of the stop and return movement with the master speed

A synchronous stop path like known with Compax M/S is not available. Instead you have the possibility to adapt the dynamics of the return movement to the current master speed. The prespecified parameters for Velocity, Accel and Decel are then valid at the master speed specified with **ScaleRet**.
In the module, a scaling of the parameters for the stop and return movement is made via the factor

ScaleRamp := C3Cam.StatusMaster_SpeedUnits/ScaleRet;

For smaller master speeds the movement to the start position is thus reduced, for higher master speeds, the dynamic of the return movement is increased, so that a certain waiting distance can be ensured before a new start.

3.9. Phase correction

(application specific extension)

Signal	Description
Enable	Enable of phase correction
OffSpeed	Offset speed for master signal
PosOffset	binary input for positive offset speed
NegOffset	binary input for negative offset speed

A phase correction with the MC_Phasing module is possible in synchronous operation (enable via **Enable**) For this, at the rising edge of **PosOffset** a far, relative target is approached with the speed **OffSpeed** using the parameters Accel and Jerk with the aid of setpoint generator PG3. With the now Phasing module, the calculated setpoint speed is interpreted as master speed offset and applied to the differentiated master position (CamManipulation_CamPositionSpeedAdditive o3022.5). The axis moves faster than the material.
the PG3 is moved to original position 0 with the negative edge at input **PosOffset**. Its position setpoint returns from **OffSpeed** to 0.

ATTENTION: MC_Phasing can only be triggered in curve operation, i.e. if DeviceState = 29 (Cam is coupled in). As soon as it is left by stop of decoupling, an immediate termination of MC_Phasing without ramp results at present. This behavior will be altered for the R3 release so that the axis stop will no longer influence the MC_Phasing.

3.10. Separation function

(application specific extension)

Signal	Description
Enable	Enable of the separation movement
TrigSource	Control variable for trigger generation
Threshold	Threshold for triggering the separation movement
SepDist	Distance for product separation
MoveVelocity	relative speed for the current synchronous speed

Task:
Synchronous to the processing cycle, the cut product is to be advanced after the cut by a specifiable distance with the aid of a superimposed feed movement in order to separate it from the product string.
This function is realized with the MC_MoveSuperImposed.
A software comparator is used as trigger.

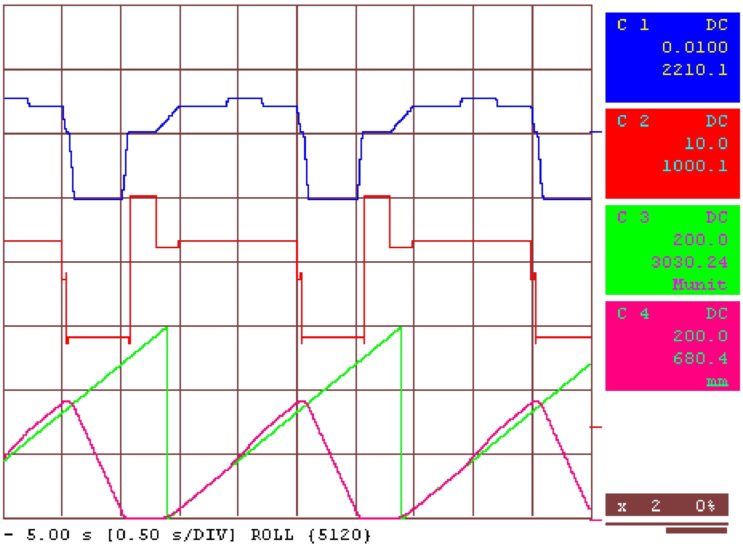
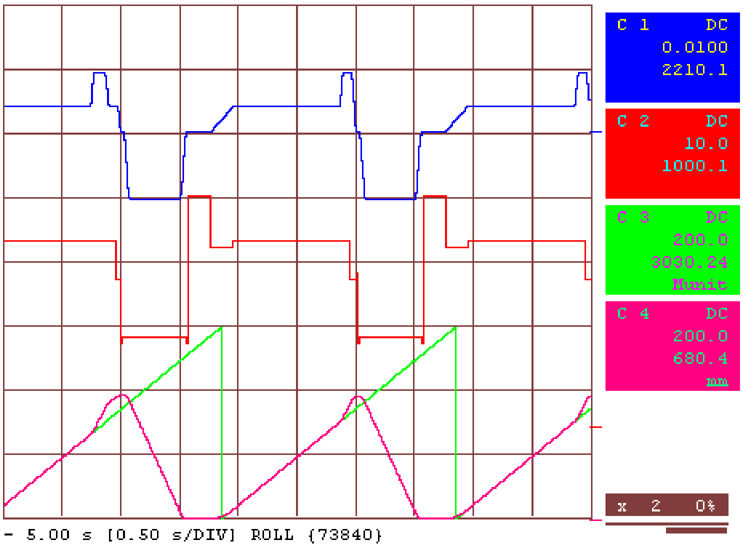


Figure 6: Timing diagram product separation

blue: Slave speed
red: DeviceState
green: Master cycle
magenta: Slave setpoint position

The enable is deduced from the status display Insync and an enable input for practical reasons.
If the software comparator is set too late, the superimposed movement can be aborted by the Stop or the enable may be entirely missed.



blue: Slave speed
red: DeviceState
green: Master cycle
magenta: Slave setpoint position

3.11. Warm start function
(application specific extension)

Signal	Description
AbsMode	Warm start operating mode = entry after Power On at the master position before Power Off

If warm start is not activated, the position of selected master source begins with a rising edge at count. With activated warm start **ABSMode** = TRUE it is verified, if the Multiturn emulation is correctly configured (C3plus.DeviceData_Multiturnemulation_Window_norm > 0) and if the axis position after switching on is ok (C3.Multiturnemulation_Status = False).
In addition it is verified, if the basic conditions for a warm start are fulfilled:
- Master at standstill before switching off (C3Cam.StatusMaster_SpeedUnits < 1.0)
- Slave in start position before switching off (waiting for coupling position, DeviceState 36)

If all conditions are fulfilled, the old value before Power Off is used as start value for the master position. Otherwise, the head cut will be performed.

Note:
- The warm start function can (in the current implementation) not be used in combination with active mark reference.
- This function requires 3 retain variables.

3.12. Special status displays

Signal	Description
ProdSpeed	Material speed in % of the slave nominal speed
ActLen	Length of material

ProdSpeed: Material speed in % relative to the nominal speed of the axis.

ActLen: Moved material length since the last processing. With mark reference mode the moved material length after label is indicated.

4. Configuration
For the configuration, the same specifications as in a Master-Slave connection are required for a gear function or cam.

In addition, any curve with linear slope and the minimum possible number of interpolation points (18 points) must be created in the CamDesigner, which is then scaled to the running time:

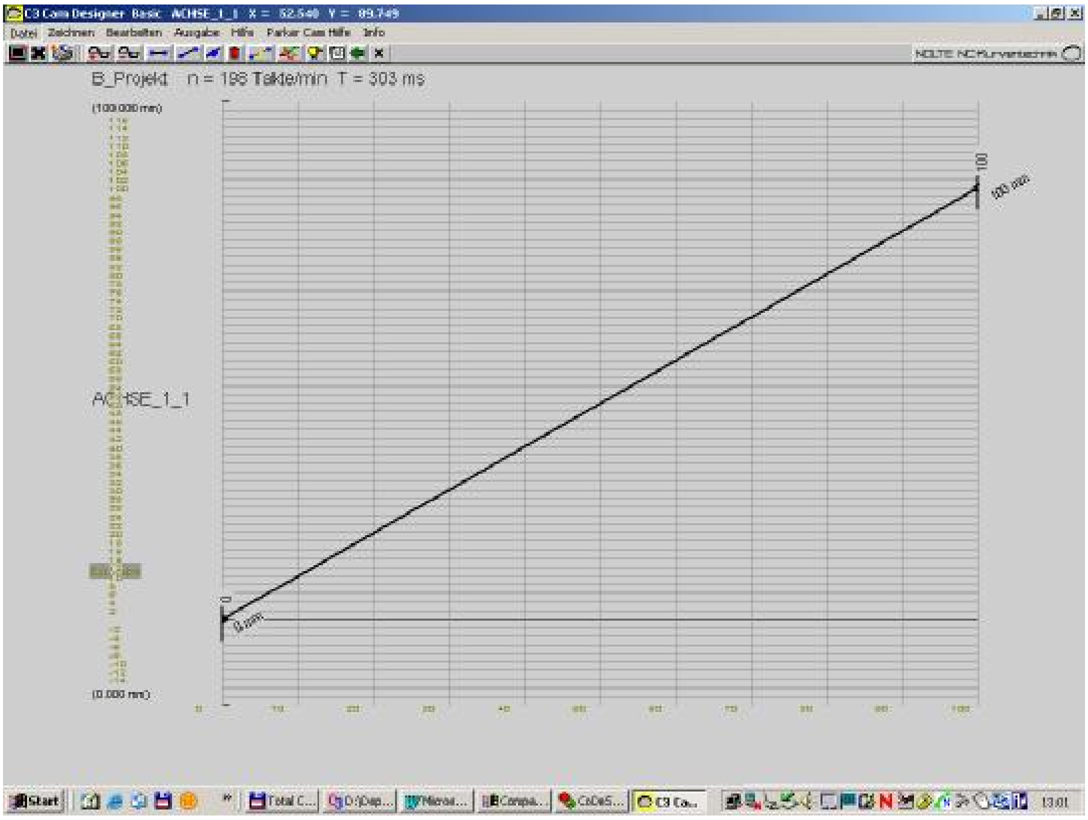


Figure 7: Straight line as curve No. 1

5. IEC program

This cutting on the fly application is based on a series of CAM-specific IEC function modules.

5.1. Concept

The following possibilities are chosen for the design of the motion sequences:

Function	Realization
Start position of selected master source	• **C3_MasterControl**; StartSource = Mark input [1]) • **C3_SetMaster** for the realization of the head cut
Acquisition of the master position	• C3_MasterControl for counting • Use of the **C3_Touchprobe** for latching the master position and correction of the master position via the offset apart from the synchronous motion; temporal precision in the acquisition of the master better than 1µs
Calculation of the coupling position	• Specification of the synchronous position, during quadratic coupling, the coupling position is automatically calculated by the cam generator
Synchronization	• Start of the cam via **C3_CamIn** with quadratic coupling function [3])
Synchronous motion	• **C3_CamTableSelect** for the realization of a defined product length via master and slave segment length • **C3_MasterConfig** for specifying the master position for warm start
Finishing the synchronous motion	• Decoupling with **MC_Stop**

Approaching the start position	• Return trip with **MC_MoveAbsolute** [2])
Phase correction	• Correction of the slave – master phase angle with **MC_Phasing** during synchronous motion.
Product separation	• defined superimposed movement of the slave axis for product separation via **MC_MoveSuperImposed**

Remarks:
1) time resolution 500µs
2) standstill between Stop and MoveAbsolute
3) Jerk free operation is not guaranteed during synchronization

5.2. Timing diagram

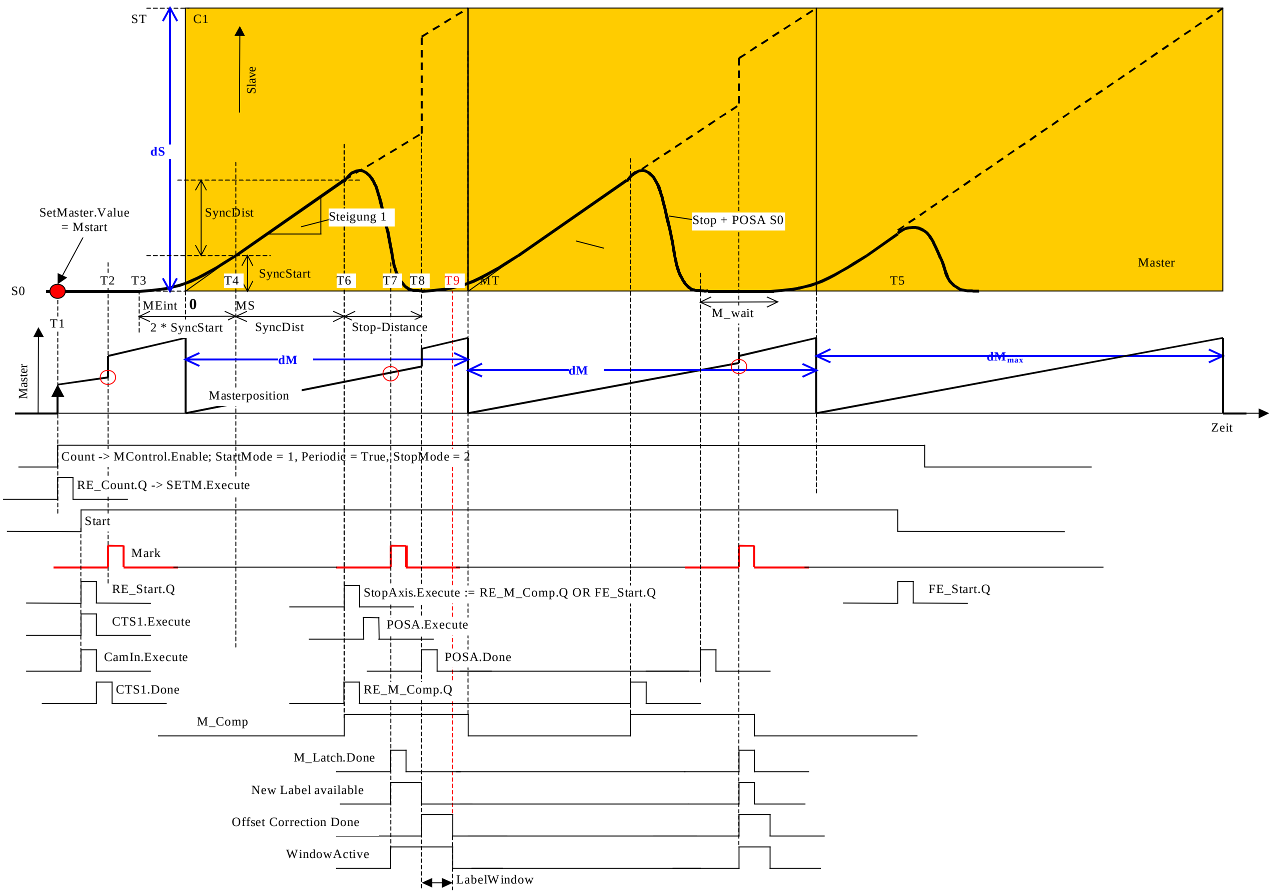


Figure 8: Timing diagram control signals

Key:
T1: Master position acquisition is started from M_start on.
T2: when the mark is detected, the master position is corrected so that the processing distance is reached at the moment of synchronous motion, i.e. dMref = CutDist – SyncStart.
T3: Start of the axis motion; synchronization to product speed Vm.
T4: synchronous speed reached, Vs = Vm. Earliest possible start of processing is indicated with InSync
T5: Synchronous motion is finished with falling edge at the start input.
T6: Exceeding the synchronous distance forces a stop.

T7: the next mark (label) may already appear during processing; here the MC_TouchProbe is triggered and the mark position is fixed (red circle).
T8: Axis stands at start position; master position is corrected so that the requested processing distance is reached with the next synchronization.
T9: The ignore window LabelWindow has elapsed, the MC_TouchProbe is activated again; from here on, a new mark (label) can be detected.

The 1. Curve is generally used:

curve segment no.	master segment distance	slave segment distance
C1 (synchronous curve)	M_cycle	S_cycle

Internal calculations in the CutOnFly module:

<table>
<tr><th>Without mark reference</th><th>with mark reference</th></tr>
<tr><td colspan="2">Specification:
SyncStart (fixed by quadratic coupling sequence)
SyncDist
ProdLength
CutDistance
SensorDist
SawCorr</td></tr>
<tr><td>Master clock distance:
M_cycle = ProdLength + SawCorr

Slave clock distance:
S_cycle = M_cycle</td><td>Master clock distance:
M_cycle = ProdLength + SawCorr
(maximum product length, must be mapped on the full circle with rotating blade)

Slave clock distance:
S_cycle = M_cycle</td></tr>
<tr><td>Waiting distance:
M_wait = ProdLength – 2 * SyncStart - SyncDist – StopPath

The StopWeg is the master distance traveled during Stop and POSA S0.</td><td>Waiting distance:
M_wait = CutDistance – SyncStart – SensorDist
(fixed by the processing distance)
M_wait must be > 0!

The actual product length results from the mark (label) distance.</td></tr>
<tr><td>Start value for master position acquisition:
Mstart = M_cycle – SyncStart – 10

This start value is only effective for the first synchronization sequence.</td><td>Start value for master position acquisition:
Temp1 := SensorDist - SyncStart - CutDistance - SawCorr
IF Temp1> 0 THEN
    M_start := Temp1;
ELSE
    M_start := M_cycle + Temp1;
END_IF
-> result must be positive, unless the product is one master cycle too short</td></tr>
<tr><td colspan="2">Parameters for coupling movement:
ME = is internally calculated
MS = SyncStart</td></tr>
</table>

Limit transition in Timing:
If the waiting distance M_wait approaches 0, the maximum cycle rate is achieved. With an even higher cycle rate, the real product length will be automatically doubled compared with the specified product length, this may then be declared as waste length.

5.3. Module overview

A mixture of CFC (main program) and ST (all FBs) is selected as programming language.
The program is divided into several function blocs:

Function blocks	language	Task
PLC_PRG()	CFC	Main program
Init()	ST	Initializations
CutOnFly()	ST	Cutting on the fly function
Control()	ST	Generation of the control signals
Status()	ST	Status Display
MoveAxis()	ST	Reference travel and Jogging
Separation	ST	Product separation (application-specific extension)
PhaseCorr	ST	Phase correction in synchronous operation (appication-specific extension)
DetectChange	ST	Detect change of a real variable (test purposes)

5.4. Main program PLC_PRG()

5.5. Initialization Init()

Everything that can be once initialized with the start of IEC and needs not be changed during function, can be stored here.

5.6. Cutting on the fly CutOnFly()

The CutOnFly() module contains the essential algorithms and motion functions for synchronization and optional return travel.
The termination of the synchronous motion takes presently place with Stop, followed by an immediate return to the start position, if desired.

FB name		CutOnFly()	
Cutting on the fly function			
VAR_IN_OUT			
VAR_INPUT			
	Count	BOOL	Start of the acquisition of the master position
	Start	BOOL	Preliminary start of the synchronization
	ProdLength	REAL	Product length without mark reference
	SyncStart	REAL	Synchronous start path with StartMode = TRUE
	SyncDist	REAL	Synchronous distance synchronous start path until Stop
	Target	REAL	Target position with reference to start position (corresp. P32)
	CutDistance	REAL	Processing distance with mark (label)reference
	ScaleRet	REAL	Reference master speed for return scaling
	ReturnMode	BOOL	Synchronization with / without return
	LabelMode	BOOL	Synchronization with / without mark (label) reference
	AbsMode	BOOL	warm start
	MoveVelocity	REAL	Speed for travel to relative target position
	Accel	INT	Acceleration during StartMode = FALSE
	Decel	INT	Deceleration during StopMode = FALSE
	AccelJerk	DINT	Jerk with acceleration during return trip
	DecelJerk	DINT	Jerk with deceleration during return trip
	BeamAngle	REAL	Diagnonal-beam angle between 0 ...80°
	SensorDist	REAL	Position of the label sensor in relation to the machine zero point
	LabelWindow	REAL	Ignore window

	ManCut	BOOL	Immediate start of synchronization
	SawCorr	REAL	Width of saw blade (cutting loss caused by processing)
VAR_OUTPUT			
	InSync	BOOL	Synchronism and synchronous comparator reached
	StartPos	BOOL	Start position reached
	LenOK	BOOL	Processing distance = product length
	LenWaste	BOOL	processing distance = waste length
	LabelError	BOOL	Label (mark) error
	ProdSpeed	REAL	relative product speed in %

6. Interfaces of the application example

6.1. Parameter interface

The control parameters are transferred in the variable array (9 columns with 32 rows each). If necessary, they can be burnt into flash after the update (takes about 2s) so that they can serve as default values after switching on the voltage again.
The contents depend on the formats of the array variables.

	Col1	Col2	Col3	Col4	Col5	Col6	Col7	Col8	Col9
Row	REAL	REAL	INT	INT	INT	DINT	DINT	DINT	DINT
1	ProdLength	JogSpeed	ModeBits	SlaveStat1	Teststorage	JogAL	JogDL	JogJerkAL	JogJerkDL
2	SyncStart	RunSpeed		SlaveStat2	Teststorage	RunAL	RunDL	RunJerkAL	RunJerkDL
3	SawCorr	RelSpeed							
4	SyncDist	VMSpeed							
5									
6	Target								
7	CutDistance								
8	BeamAngle								
9	SensorDist								
10	Threshold								
11	SepDistance	Teststorage							
12		Teststorage							
13		Teststorage							
14		Teststorage							
...									
32									

6.2. Binary control signals

Control bit input:

Bit	Name	Description
0	Energize	↑: Energize motor ↓: Disable motor and acknowledge error
1	Home	↑: Reference travel and then approach start position
2	HandP	↑: Jog forwards ↓: Stop
3	RUN	↑: Start synchronous motion + phase correction 1: cyclic operation with LabelMode = FALSE
4	Label	fast mark input (time resolution 500µs)
5	End1Ini	Limitswitch 1
6	End2Ini	Limitswitch 2

7	RefIni	reserved for Reference switch

6.3. Binary status signals

Status bits:

Bit	Name	Description
0	Powered	Drive energized
1	Fault	Malfunction
2	PosWarn	Following error warning
3	PosErr	Tracking error
4	StartPos	Start position reached
5	RefOK	Reference travel executed
6	InSync	Synchronous motion active
7	LabelError	Label (mark) error

6.4. Intervention on object level

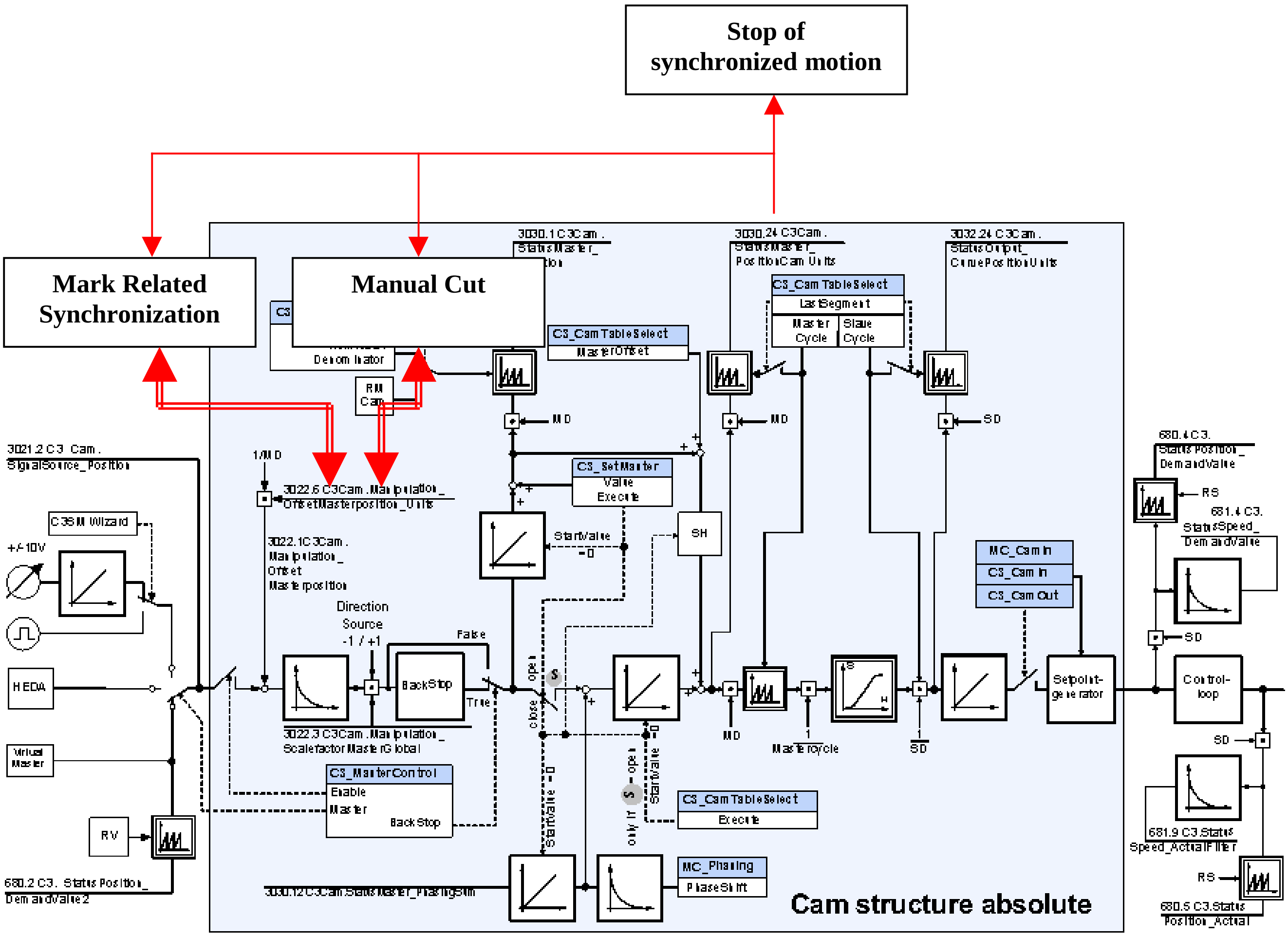


Figure 9: Intervention in master position acquisition

Object	IEC name	IEC Function
o3022.6	C3Cam.Manipulation_OffsetMasterposition_Units	Mark reference, manual cut
o3022.3	C3Cam.Manipulation_ScalefactorMasterGlobal	Diagonal-beam saw
o1130.3	C3Plus.HOMING_speed	Homing (MoveAxis)

o1130.1	C3Plus.HOMING_accel	Homing
o1130.2	C3Plus.HOMING_jerk	Homing

7. Performance

7.1. IEC reaction times

The C3-IEC task runs typically with 4-10ms and detects the start signal with this time variance. During mark (label) reference, the MasterControl.StartMode = 2 is indispensable. The mark (label) sensor itself must be referenced with MasterControl.StartSource. The use of MC_TouchProbe during the implementation of the mark (label) reference allows a temporal exactitude of <1µs.