SIMATIC S7-1500T FlyingSawAdvanced

LFlyingSaw for SIMATIC

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1 Basic information

1.1 Aim and purpose of this application

1.1.1 Task

A material web that is fed in using a material feeder is to be processed, where the processing (e.g., cutting) cannot be carried out in a short time window but takes a slightly longer period. In order that the material web motion has no effect on the processing, the processing device must move in synchronism with the material, i.e., it must be processed "on the fly".

Why on-the-fly processing?

"On-the-fly" processing is required, if:

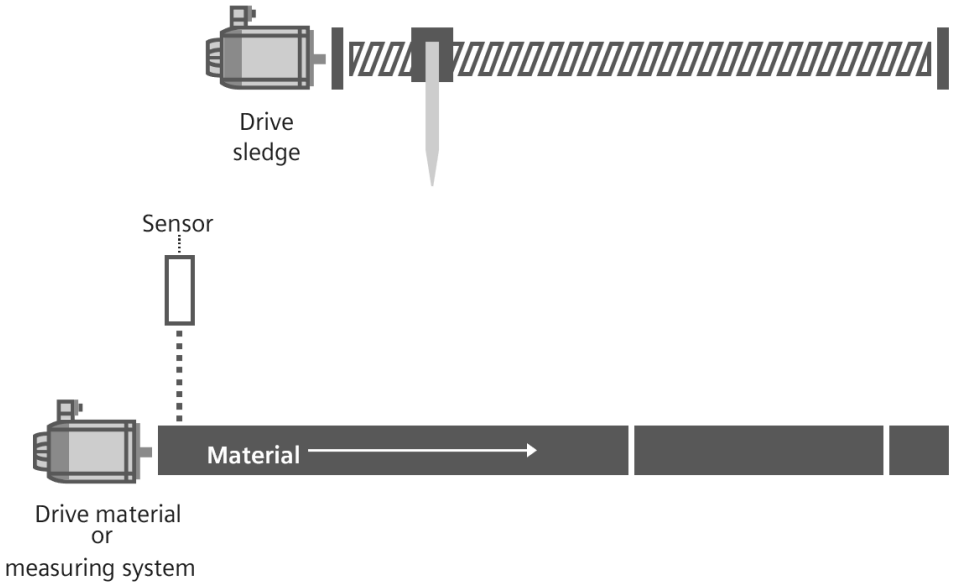
- Production processes cannot be stopped (e.g., extruders).
- Stopping the material web and the associated acceleration and deceleration forces cannot be realized.
- The individual processing steps are too different, so that a uniform wait time is no longer feasible from an efficiency perspective.

Basic design of a flying saw

The material is fed to the processing unit with a constant velocity.

The cut position on the material web is either sensed using a sensor and an appropriate mark – or is specified by the control after an adjustable cut length. At the same time, the synchronous position is defined, from where the shears slide of the flying saw travels in synchronism with the position where the material is to be cut and the cutting operation can be started. After cutting has been completed, the shears slide is positioned back to its initial position, where it waits for the next cut position.

Fig. 1-1: Principle of operation of a flying saw



1.1.2 Advantages of the standard SIMATIC application Flying saw

The standard SIMATIC Flying Saw application presented here helps to implement the described tasks – and allows a functioning application to be developed as quickly as possible.

The standard application includes a function block that controls the flying saw and controls motion using parameters corresponding to the specific application.

Using the user program, only the material feed must be controlled.

Further, the standard application includes a block to connect a user interface (HMI) to test and diagnose the flying saw functions.

The standard SIMATIC Flying Saw application offers users many advantages:

- **Fast program generation**
  The standard application SIMATIC Flying Saw allows the functionality of a flying saw to be quickly and simply implemented based on a SIMATIC S7-1500T controller.

  The function blocks included in the standard application can be quickly and simply transferred into the application to be generated by copying. Configuring steps that are additionally required are explained in this description.

- **Automatic motion control**
  The core functions of the standard application completely handle the motion control based on the technology functions of the S7-1500T controller. The user only programs a control sequence that corresponds to the behavior of his machine function sequence to be implemented.

- **Adaptability**
  All of the source codes are available in commented form for the standard application. Therefore, the core functions can be simply and quickly expanded to include customized functions.

1.2 Components included in the standard application

The standard SIMATIC Flying Saw application is implemented in the form of a library.

This library is used in a project that is supplied.

This project is used to quickly understand the functionality, commission the application and diagnose the standard SIMATIC Flying Saw application.

The program has the following tasks:

- Represent the FB-FlyingSaw from the perspective of the user program
- Allow all interfaces of the standard application to be used and operated
- Visualize all the relevant data of the standard application
- Graphically represent the synchronizing operations
- Incorporate the additional library of the axis FB.

In this way, the core functions of the standard SIMATIC Flying Saw application can be quickly and simply integrated in projects that users have created themselves.

2 Range of applications

2.1 Application

2.1.1 Available controllers

The standard SIMATIC TIA flying saw application can be used on any SIMATIC S7-1500T controller with Firmware 2.9.4 or higher. Therefore you need at least TIA Portal V17.

2.1.2 Tasks that can be addressed using the core function

The core function is used to control flying equipment, for example for

- Cutting
- Perforating
- Embossing
- Sealing
- Sawing
- Drilling
- Painting
- Measuring
- etc.

Definition

In the following, the term **flying saw** is representative for all other conceivable machine versions.

Further, the term **"Saw"** is representative for the part of the machine that is in direct contact with the material.

2.1.3 Features of the application

The following features have been implemented and can be used in the user program.

Providing the leading value for cutting

The "flying saw" can be provided with a leading value for cutting in the following ways:

- Axis with actual value/setpoint coupling
- External encoder with actual value coupling
- The application does not change the leading value. Users can configure the leading axis as either linear or as modulo linear axis.
- It is possible to switch over the leading value during run of the web.

Cutting to length

- The cut length can be adapted at each cut

Sensor-defined cut position

- The distance between the sensor and cutting unit can be freely configured
- Sensing the cut is independent of the motion of the cutting unit
- The measured values are saved to a buffer memory
- The measuring points can be simulated (for commissioning)
- An active range can be defined for the measurement based on the format length.
- An alarm is output if a measurement is not realized in the active range. A counter is also incremented. A cut is made over the defined format length. The new active range is calculated based on the position of the last cut and the format length

Traveling to the transfer position

- After the cut, the material can be accompanied by the saw up to a defined transfer (handover) position

Creating a gap

- A "positive" gap can be created after the cut. The material is shifted relative to a defined length
- A "negative gap" can be created before approaching the transfer position. This is required in order to retract the material from the saw clamping mechanism before the transfer position is approached

Dynamically defining the next start position

When calculating the next start position, the flying saw can already be returning to the start position. Application for this function include:

- If natural materials are cut, then each cut can take a different time. On the average, the cutting time must be so short that the flying saw reaches the start position. However, if individual cuts take a longer time, then the flying saw can move in the direction of the defined end position
- A cutting unit should cut several short formats quickly one after the other, then followed again by a long format. During the short formats, the machining unit traverses in the direction of the end position; during the long format, it can go back to the start position
- Cutting "short" lengths from the transfer position, without the set start position being able to be reached

Specification of synchronous position

The synchronous position

- can be entered by value
- dynamic calculated in relation to web velocity

Running back optimization

- For fixed format lengths, for the return travel, the acceleration (optimized according to the torque, the thermal utilization), or the jerk (optimized according to the mechanical stress) can be adapted, so that the flying saw reaches the start position just before the start of the next synchronization
- The block automatically calculates the dynamic responses

Precisely synchronizing at a specific position

- The application provides "by time", and "by distance" (typically symmetrical) modes. The synchronization mode required depends on the constraints imposed by the mechanical system. The coupling type (setpoint/actual value coupling) and the maximum permissible drive torque) also have an influence

On the spot cut

- The material is cut when it is at a standstill
- The material is cut when it is moving only in the mode "cutting to length"
  (A cut is initiated by the operator, independent of the material distance traveled)

Skip next cut

On operator request or by initiation of a supervision system that detects web problems leading to a damage of the cutting system, when cutting

Interrupt / continue production

- The flying saw is stopped for brief maintenance work while the material web is running in the automatic mode (actual cut length and/or measured value buffer are kept)

Gear ratio between flying saw and the material

A gear ratio can be set between the material velocity that can be measured – and the material velocity active when cutting

- For instance, this is required when cutting wound paper cores as the material is wound with a skew, and therefore the material velocity measured using a measuring wheel does not correspond to the resulting core velocity
- Sawing and synchronizing with just one drive is another application. This diagonally moves the saw over the material web, which results in synchronous travel and cutting motion at the same time

Calculating the cut material length

- The calculation is based on the actual position and the runtime compensation

Control using the mode manager

- Initial position: The axes are activated – and the defined start or maintenance position approached
- Automatic: Process mode
- Manual: Standard interface to control basic axis functions – such as homing, jogging, ...

HMI with associated interface

- Optional commissioning/test interface in parallel to control from the user program
- Simulation of process feedback signals for test operation without material

Activation length when searching for the print mark

- Length that must be traveled through until the measured value acquisition is activated

Permanent print mark search

- The measured value acquisition permanently searches for a print mark without considering cut length (raster) and activation range

Wait for print mark on request

- The measured value acquisition is requested to search for the next print mark outside of the cut length (raster). If the print mark was found, then from this position, a search is made for the next print mark within a fixed raster.
  This function is used to synchronize cuts to a new or offset raster.

Central axis handling

- Technology and axis handling are separate.
- The application uses the functions of the "LAxisCtrl for SIMATIC" library to control the axes. When the flying saw is in the manual mode, users can issue motion commands, such as homing or jogging via the known interface of this library.

Multi instancing

- If it is necessary, more than one flying saw system can be operated in one CPU. Only limited by capacity of CPU

Double Cut

- The application offers the possibility for short cuts after and before a longer cut to do a double cut. This means the sledge delays exact for the short format length during synchronous phase and is not going to standstill before doing the short cut (double cut)

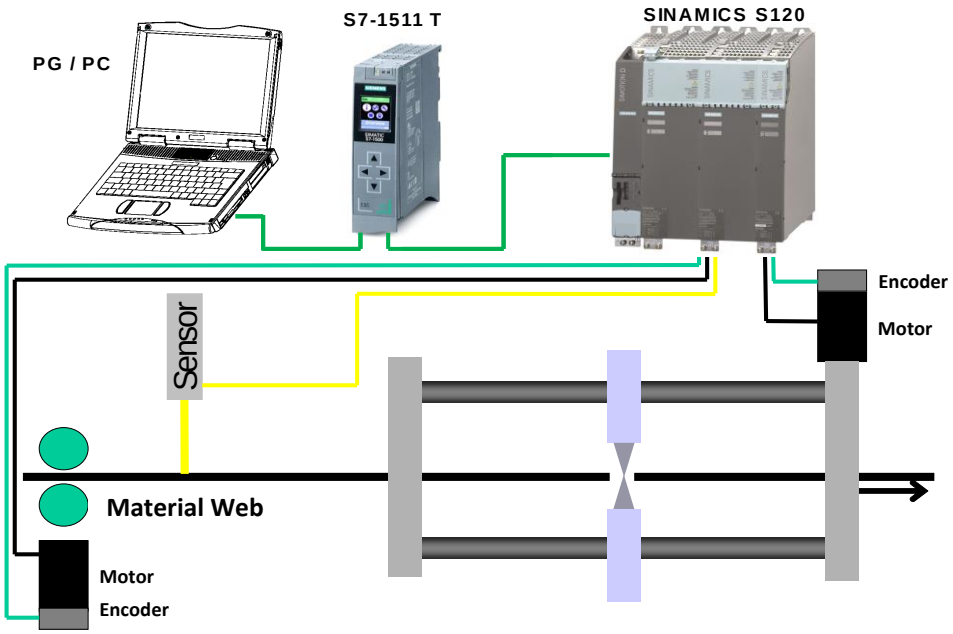
2.2 Application environment

The standard SIMATIC Flying Saw application can be used in the following hardware environment:

- Real machine
- Demonstration application (e.g., demonstration case or drives/motors without coupling to a real machine in a laboratory set up!)

2.2.1 Real machine

Fig. 2-1: Application environment of the standard SIMATIC TIA flying saw application with a real machine



SIMATIC can be used to control the material feed and the drives of the flying saw. Alternatively, the flying saw can be coupled using a machine encoder.

3 Geometry and function

3.1 Design of the flying saw

The application based on the flying saw comprises, for example, a spindle axis, to which the cutting unit is attached.

Fig. 3-1: Physical variables of the flying saw application

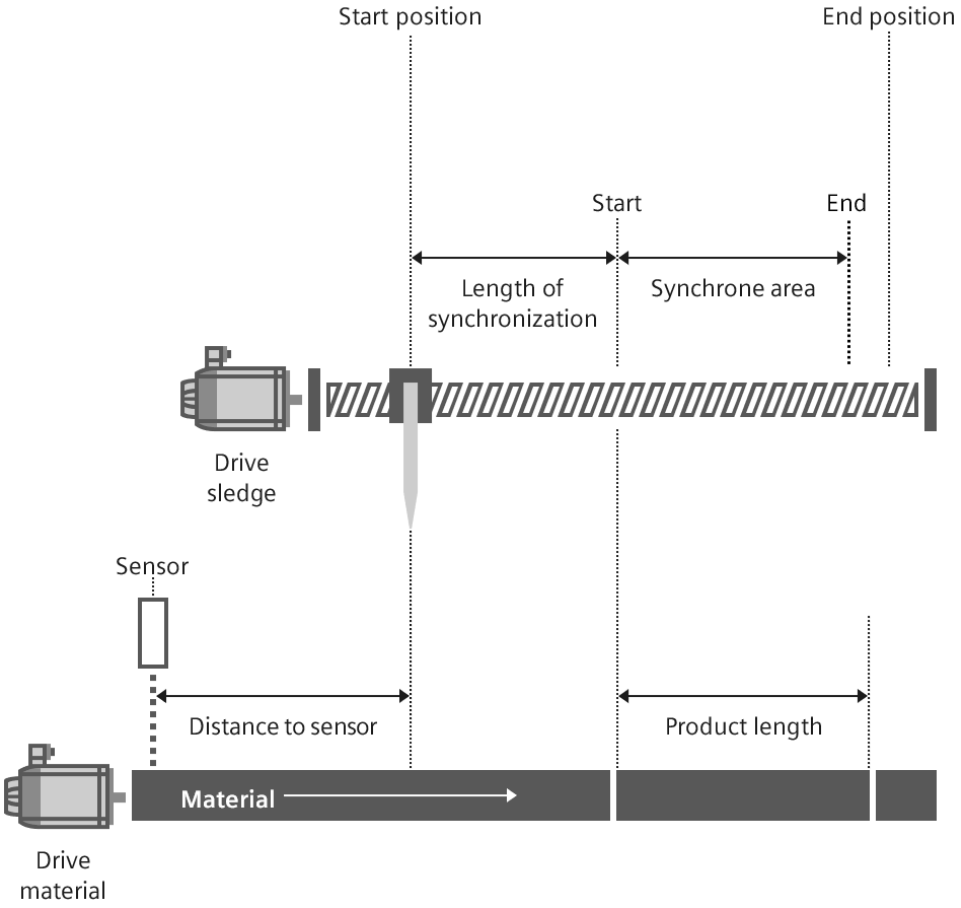


Table 3-1: Explanation of the parameterizable physical variables

Physical variable	Description
Distance to sensor *usersInterface.* *distanceToSensor* [mm]	Distance between the axis zero point of the flying saw and the sensor used for material and print mark detection
Start position *usersInterface.* *startPos* [mm]	Standstill position of the cutting unit with reference to the axis zero point of the flying saw.
Start (synchrone area) *usersInterface.* *syncPos* [mm]	The position where the cutting unit reaches the specified material position and material velocity. Starting point of the synchronous range
End (synchrone area) *usersInterface.* *endSyncPos* [mm]	End point of the synchronous range. If the cutting operation has still not been completed at this position, then it is canceled.
End position *usersInterface.* *endPos* [mm]	End point of the traversing range of the flying saw (e.g., software limit switch!)

3.2 Application modes SIMATIC Flying Saw

The application automatically controls the flying saw to implement the required functionality.

This functionality is subdivided into five operating states. The flying saw sequences are realized in the corresponding operating modes or transitions between them.

Therefore, the user only influences the flying saw by entering the required mode.

Figure 3-2 Operating Modes

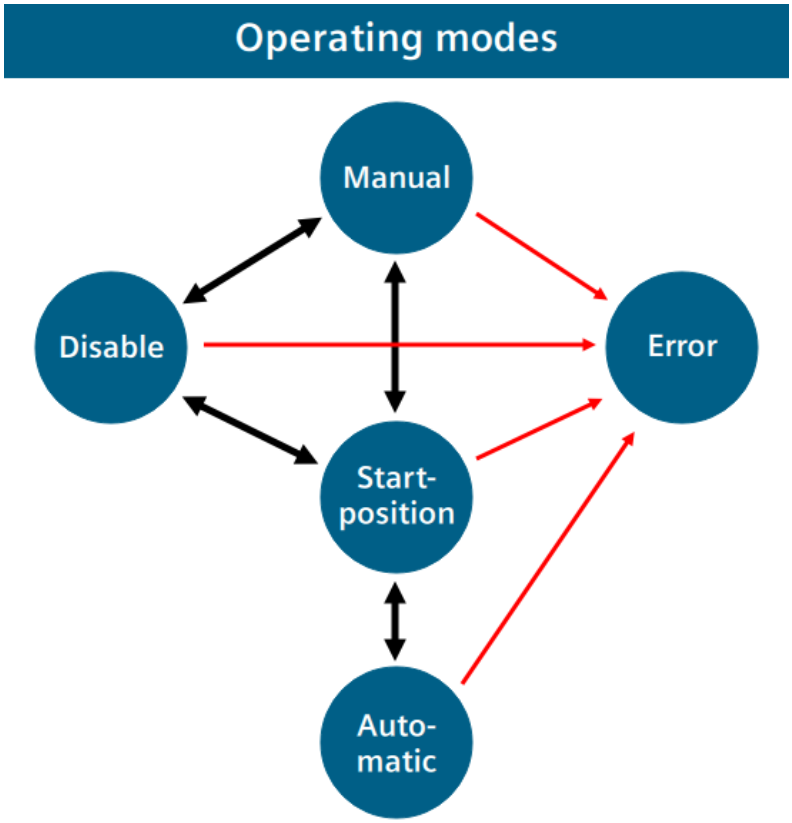


Table 3-2: SIMATIC Flying Saw application operating modes

Operating mode	Description
ERROR (0)	An error has been identified – and the flying saw brought into a safe state. The error is still active and can be evaluated by the user. The flying saw axis has been stopped and deactivated.
DISABLE (1)	The flying saw is ready for use, the drive has not been enabled. All active faults have been successfully acknowledged. The flying saw axis is in the status after a reset, deactivated and stopped.
START POSITION (2)	The flying saw is at the start position – and is ready to be synchronized to the material web. The flying saw axis is activated. The axis waits in the START POSITION mode.
AUTOMATIC (3)	The flying saw is operational. The application synchronizes the shears to the material corresponding to what has been parameterized.
MANUAL (4)	The flying saw is in the manual mode, and the user can manually move the axis.

These modes are available to implement machine functionality in the user program and can be transferred to function block *LFS_FlyingSaw* via input parameters.

The function block indicates the actual state that has been reached using an output parameter.

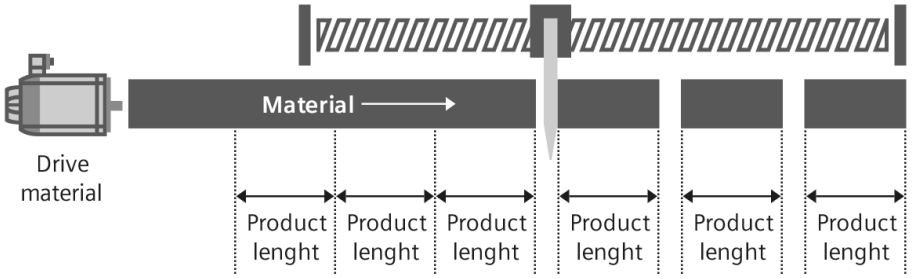
3.3 Mode of operation

3.3.1 Possibilities of determining the cut position

Users can select one of the following methods:

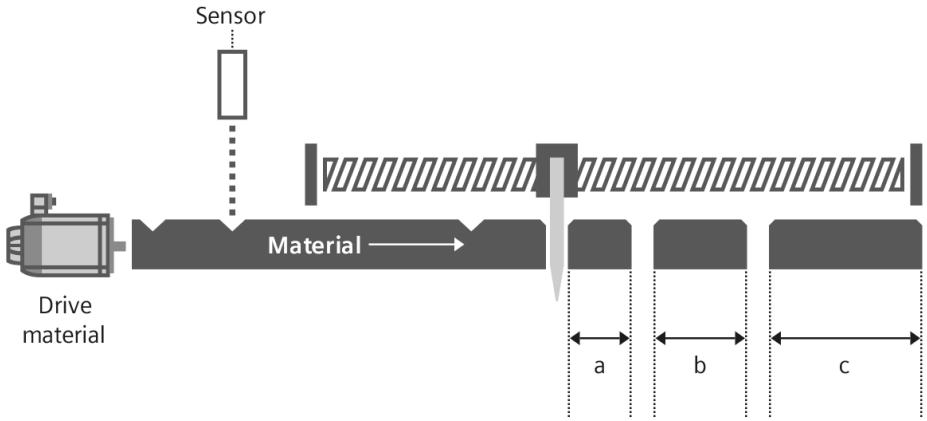
- CP_CALCULATED: cut to a parameterized cut length

Figure 3-3 CP_Calculated



- CP_MEASURED: cut to a mark

Figure 3-4 CP_Detected



CP_CALCULATED

The material is always cut at the position derived from the actual material position and the cut length.

Precondition:

- The material axis is created as a linear axis **with** or **without** modulo length.
- The FlyingSaw block is in the "AUTOMATIC" operating mode

First cut at standstill:

- The cut is initiated with a positive edge at input "onTheSpotCut"
- The cut position is determined from the actual material position
- After a successful cut, the next cut position is calculated by increasing the actual cut position by the cut length and saved as the next cut position

First cut from the motion:

- When the "AUTOMATIC" mode is activated, the new cut position is determined from the actual material position and the specified

synchronization, so that the shears can synchronize by the time this position is reached.

- After a successful cut, the next cut position is calculated by increasing the actual cut position by the cut length and saved as the next cut position

All other cuts:

- After a successful cut, the next cut position is calculated by increasing the actual cut position by the cut length and saved as the next cut position

Immediate cuts are possible at any time if the shears are at the start position, and output "onTheSpotCutPossible" is set.

CP_MEASURED

The positions at which the material should be cut are determined at the measuring location in front of the flying saw, interpolated to the synchronous position and entered a circulating buffer. The flying saw reads these values from the buffer and deletes them once the position has been cut. The required offset between the cut and mark can be set by adapting parameter "distanceToSensor".

Precondition:

- The material axis is created as a linear axis **with** or **without** modulo length
- A sensor is necessary if CPM_DETECTED is activated

CPM_DETECTED:

- A sensor at the leading value is necessary
- The application waits for a 1st measured value, interpolates this to the synchronous position and enters it into the circulating buffer. In this case, after the measuring system has been activated, the system can wait for an adjustable activation length to be traveled through
- **UsersInterface.LookForFirstPrintmarkRequired**:
  - Can be activated during automatic run for detecting a new printmark as first printmark
  - The measuring system is then interpolated by the cut length for the next measured value and activated based on an activation range
- **UsersInterface.LookForFirstPrintmarkPermanent**:
  - Measuring input detects every printmaker on material, cut length **is not** considered for detecting
  - Cut length **is** considered for adapting the start position, when no printmark is detected, the application calculates the time in which the saw must reach it start position for the next cut. Therefore, enter the lowest possible cut length, so that the start position will be adapted if needed
- If a measured value is identified, then this is interpolated to the synchronous position and entered the circulating buffer
- If a measured value is not identified, then an error counter is incremented, and the old measured value increased by the "cut length" – interpolated to the synchronous position – and entered as new "measured value" into the circulating buffer
- The error counter is reset with the next successful measurement
-

CPM_SIMULATED:

- A sensor is not required
- When activating the application automatic mode, the actual leading value is automatically interpolated to the synchronous position and entered as 1st measured value in the circulating buffer.
- All additional "measured values" are determined by coupling with the "cut length" and interpolating to the synchronous length; they are then subsequently entered the circulating buffer.

Immediate cuts are possible in the CP_MEASURED mode.

3.3.2 Synchronization

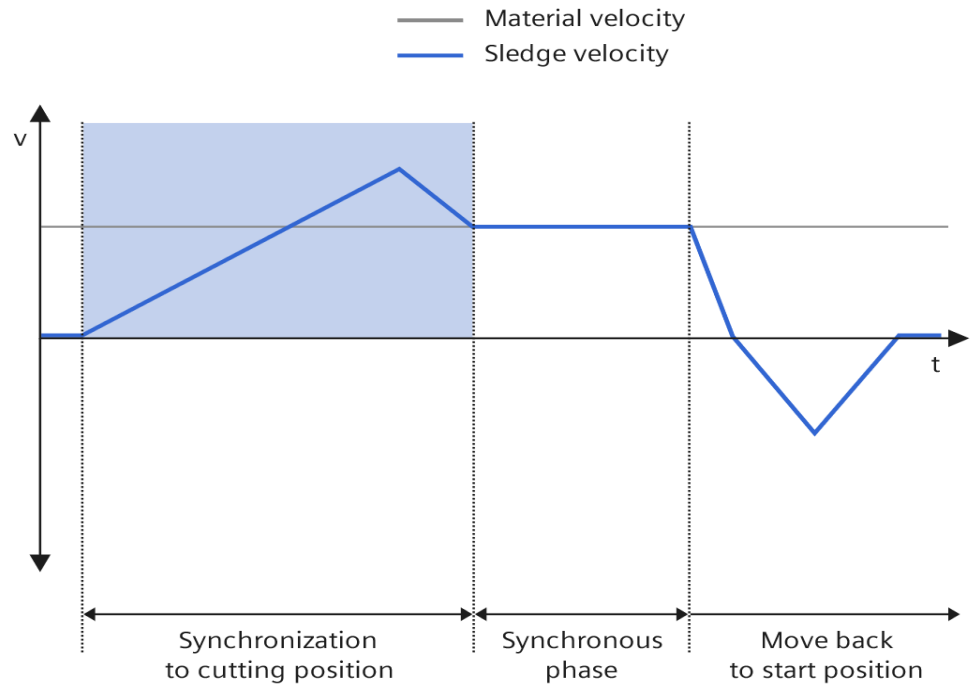
Users can make a distinction between three synchronization types:

- With velocity overshoot
  - BY_TIME
  - BY_LEADING_AXIS_VALUE
- Without velocity overshoot
  - SYMMETRIC

With velocity overshoot

If the dynamic response values are high enough, the saw waits before starting synchronizing motion, and then accelerates to a velocity higher than the material velocity in order to catch up with the synchronous point. The velocity increase in the synchronization phase depends on the parameterized synchronizing velocity. In order that the saw can synchronize, the velocity must be higher than the material web velocity. The synchronization distance is obtained from the parameterized dynamic response values.

Figure 3-5 synchronizing with velocity overshoot

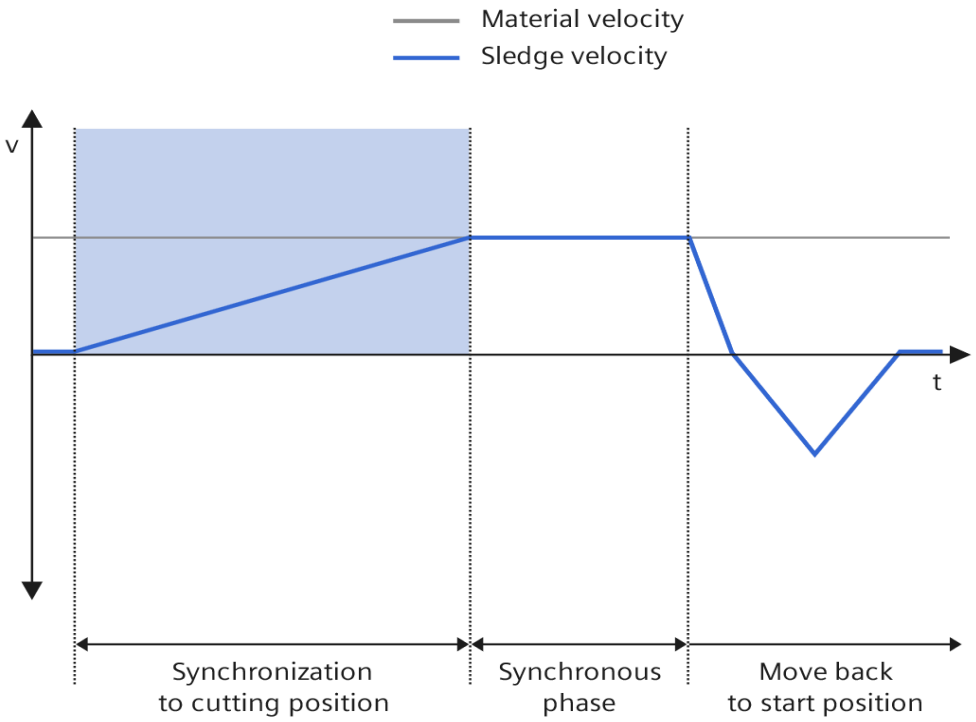


If the dynamic response values have been selected too low, the saw does not start and error message "Sync not possible" is output

Without velocity overshoot

For setting SYMMETRIC, the distance is dimensioned so that symmetrical synchronization is achieved without requiring excess velocity. The saw starts with synchronizing motion so that when it reaches the material velocity then it has precisely caught up with the synchronous point.
In this case, Synclength = 2x (SyncPos – StartPos).
The synchronization is realized with a constant acceleration rate. In this case, acceleration and jerk cannot be directly influenced.

Figure 3-6 Synchronizing without velocity overshoot



If SyncLength is selected to be too short, then the saw does not start – and error message "Sync not possible" is output

A continuous acceleration rate is also used in the BY_LEADING_AXIS_VALUE mode. The dynamic response values are indirectly influenced via the configured synchronization length

3.3.3 Options of defining the reversal position

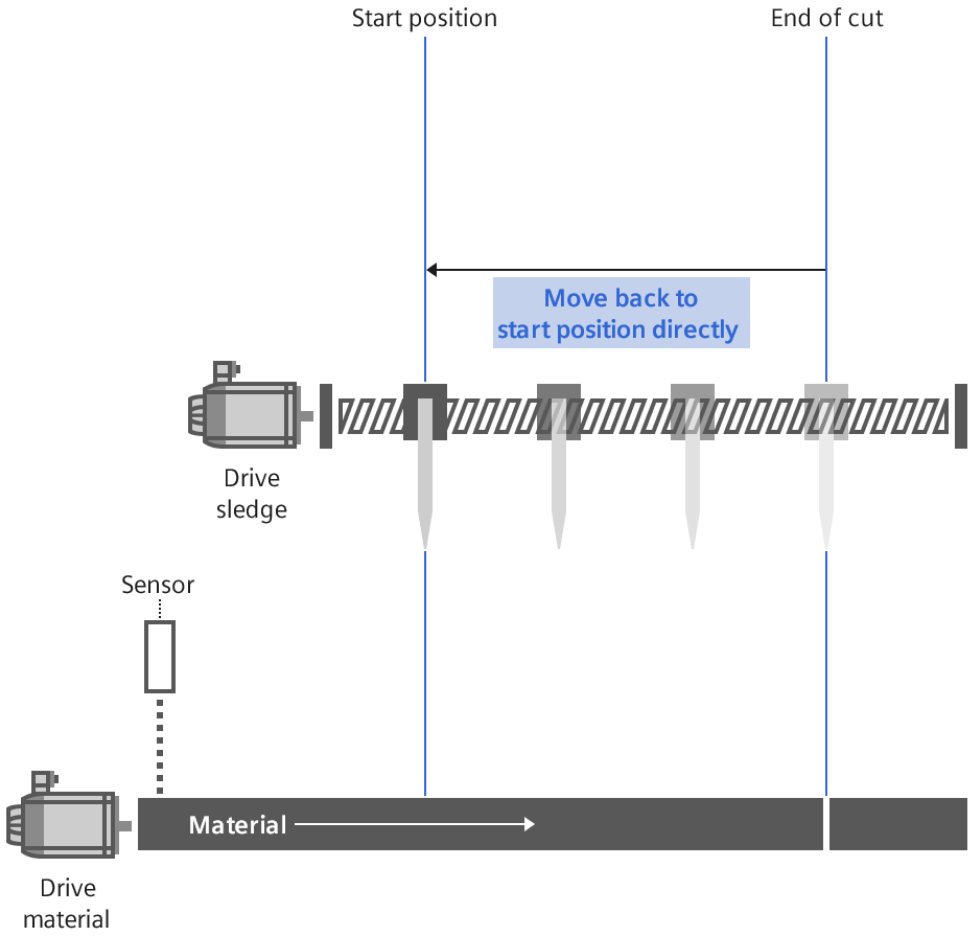
After the cut, the flying saw can immediately reverse, or convoy the material to a defined transfer position.

If in both options the start position cannot be reached in time before having to synchronize on material again, the application **calculates automatically a new shifted start position** which is in between the range of start position and the maximum start position. This function cannot be disabled.

MOVE_ZERO_POS

Immediately after executing its tasks (cut and creating a gap, if activated), the saw returns to its start position.

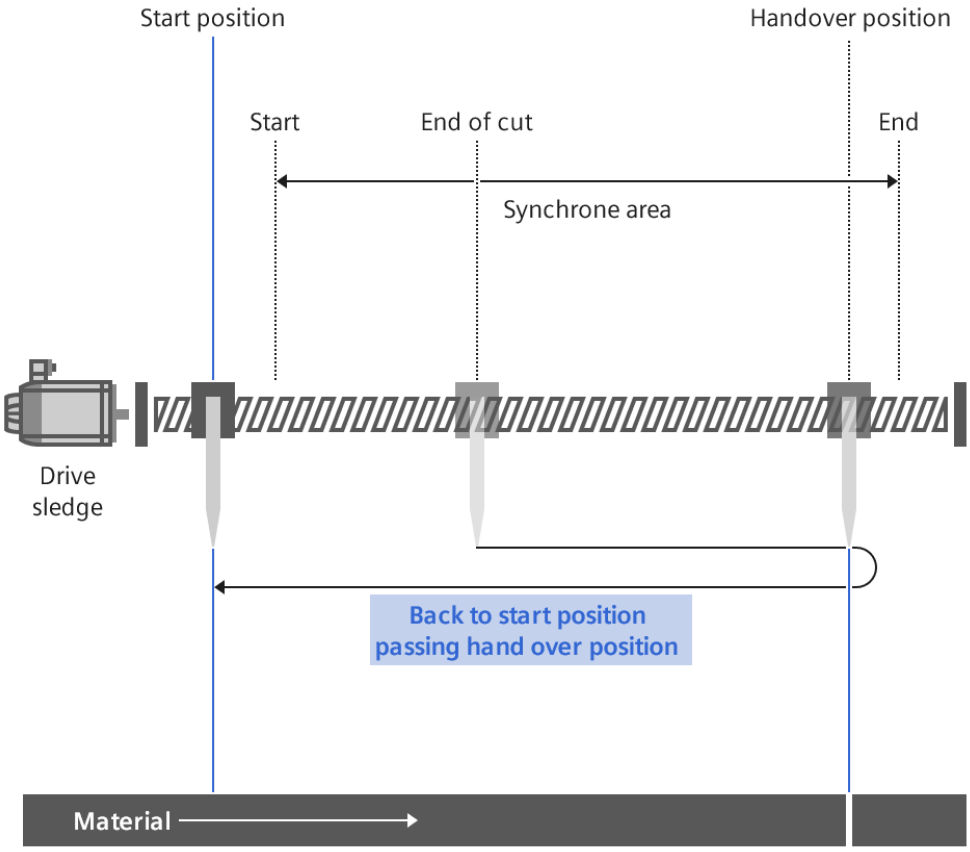
Figure 3-7 Move to start position after cut



RUN_HANDOVER_POS

After the cut, the saw accompanies the material to the transfer position, and then returns to the start position

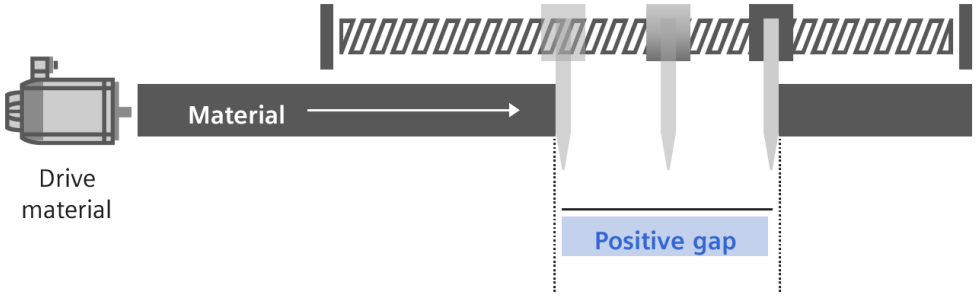
Figure 3-8 Convoy material piece to handover position after cut



3.3.4 Creating a gap

GAP positive

Figure 3-9 creating a positive gap



- **MOVE_ZERO_POS:**
  - A "positive" gap can be created after the cut. The material is shifted in relative terms by the saw in the cutting position by a defined length in the transport direction
- **RUN_HANDOVER_POS:**
  - A "positive" gap can be created after the cut. The material is shifted in relative terms by the saw in the cutting position by a defined length in the transport direction. The shears then accompany the material to the transfer (handover) position

GAP negative

- **MOVE_ZERO_POS:**
  - No “negative” gap is possible, saw returns directly to start position after knife is out of the material
- **RUN_HANDOVER_POS:**
  - A "negative" gap can be created after the cut. In this case, the saw is first retracted out of the material and then the shears slide is moved relative to the material in the opposite direction to the transport direction through a defined length. The shears then accompany the material to the transfer (handover) position. This means that the material can be moved for transfer from the clamping range of the saw

3.3.5 Dynamically defining the next start position

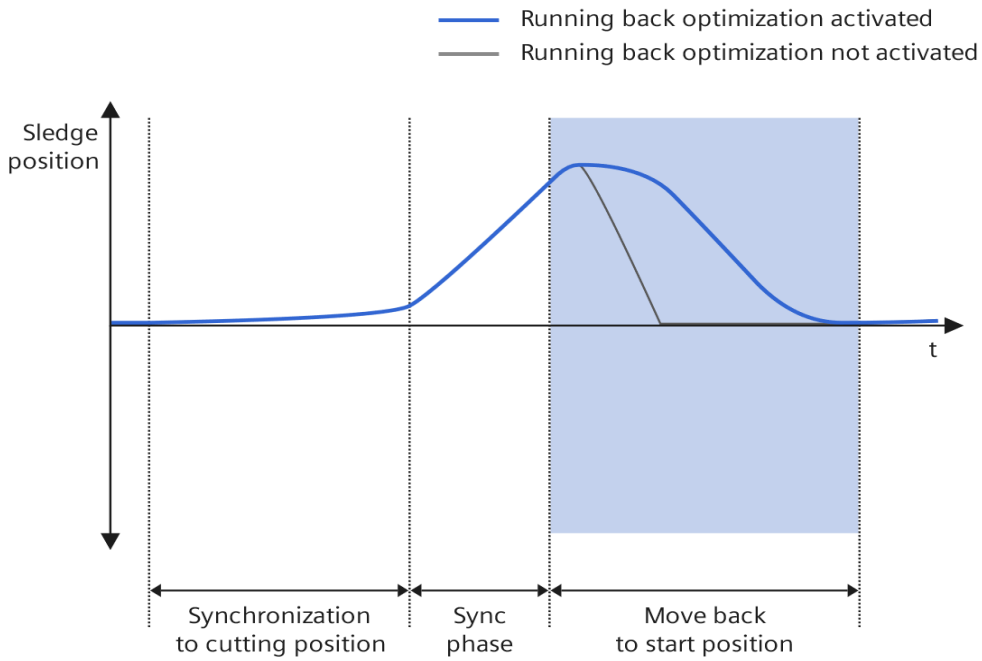
At the start of synchronization, the flying saw can already be on its return travel to the start position. This functionality is required for the following applications:

- If natural materials are cut, then each cut can take a different time. On the average, the cutting time must be so short that the flying saw reaches the start position. However, if individual cuts take a longer time, then the flying saw can move in the direction of the defined end position until the maximum start position has reached.
- A cutting unit should cut several short formats quickly one after the other, then followed again by a long format. During the short formats, the machining unit traverses in the direction of the end position; after the long format, it can go back to the start position.
- Cutting "short" lengths from the transfer position, without the set start position being able to be reached.

3.3.6 Dynamic running back operation Running Back Optimization (RBO)

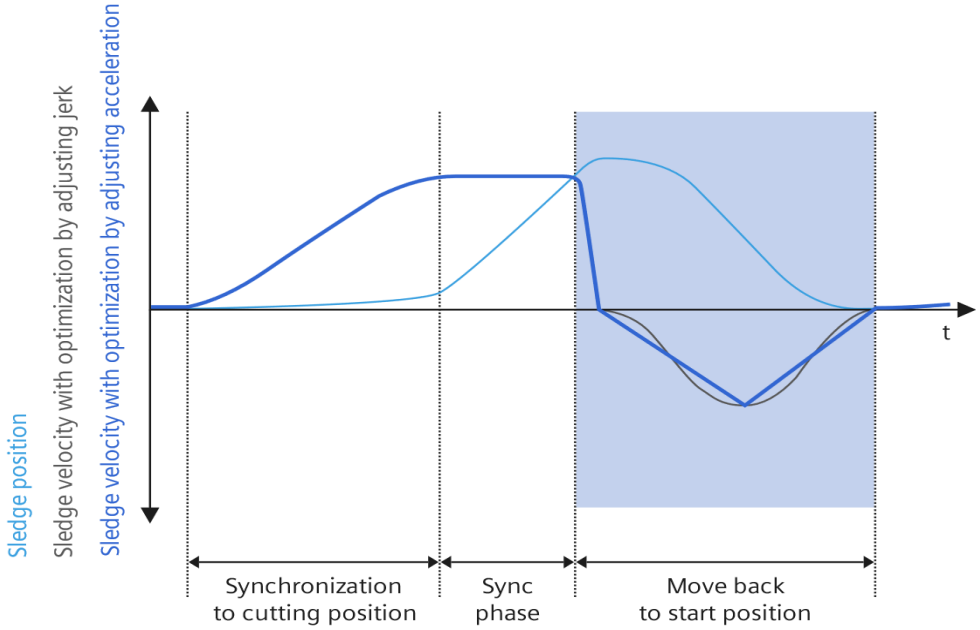
For fixed format lengths, for the return travel, the acceleration (optimized according to the torque, the thermal utilization), or the jerk (optimized according to the mechanical stress) can be adapted, so that the flying saw only reaches the start position at the next synchronization start. The block automatically calculates the dynamic responses.

Figure 3-10 Difference RBO activated and disabled



RBO by adapting jerk or acceleration

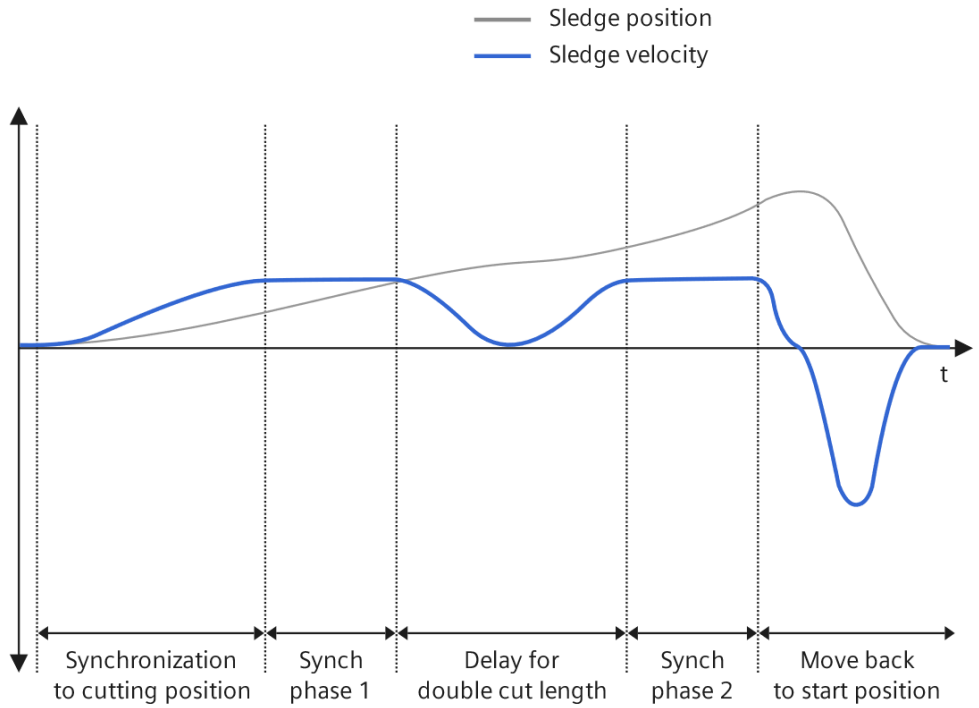
Figure 3-11 Difference RBO adapting jerk or acceleration



3.3.7 Double Cut

In case you want to make a very short follow-up cut once or always after a long cut, the double cut function has been implemented. With the double cut, the saw does not synchronize after the first cut, but is delayed by the entered double cut length and then the second cut can be made.

Figure 3-12 Position and velocity of flying saw during double cut

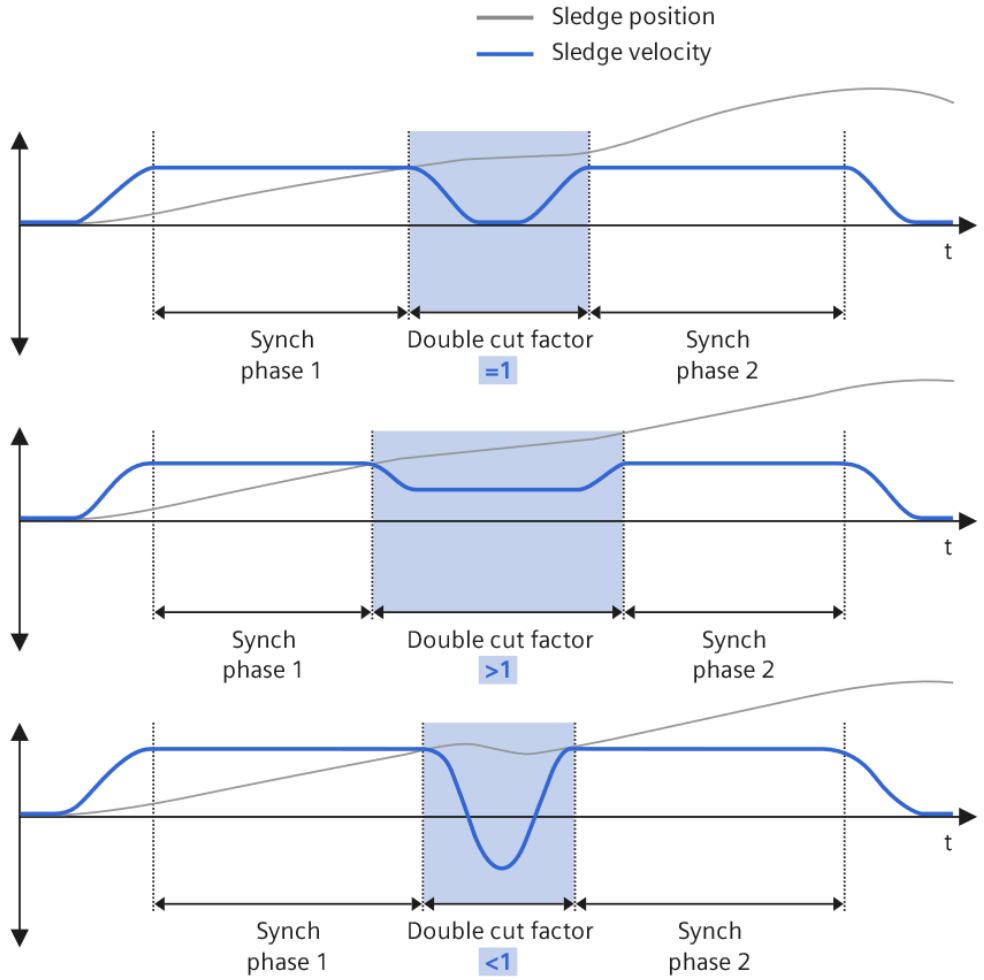


Note When using double cut, pay attention on the double cut length, if this is too big the way of the flying saw may not enough.

Double cut dynamic factor

By value of the parameter “usersInterface.doubleCutDynamicFactor” you can influence the dynamics of the delay. With a factor equal to 1.0 the length of the delay is equal to the double cut length. With a factor greater than 1.0 the length of the delay is increased (smaller dynamics) accordingly and with a factor smaller than 1.0 it is decreased (higher dynamics).

Figure 3-13 “usersInterface.doubleCutDynamicFactor”



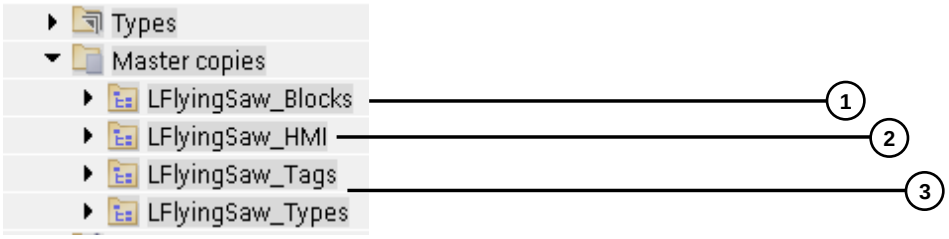
4 Description of the integration into the user project

4.1 Integrating the LFlyingSaw into a STEP 7 project

The following table lists the steps to integrate the LFlyingSaw library into a STEP 7 project. The library blocks can then be used.

Note The precondition is that a STEP 7 project must exist

Table 4-1 Integration of the library into STEP 7

Step	Task
1.	Unzip library LFlyingSaw_Vx.x.x.zip to a local folder.
2.	In the TIA Portal, select "Options" -> "Global libraries" -> Open library…."
3.	Search for file LFlyingSaw_Vx.x.x_.al
4.	It is in subfolder LFlyingSaw of the unzipped zip file.
5.	Open the global library in the read-only mode.
6.	Select the master copy to be copied into the project 
7.	Integration of the LAxisCtrl library according to the manual en: https://support.industry.siemens.com/cs/ww/en/view/109749348

No.	Task
1.	The blocks under LFlyingSaw_Blocks must be copied to the user program.
2.	Additionally, the HMI project must be integrated into the project by drag and drop.
3.	In addition, independent of the leading value type LFlyingSaw_Tags and LFlyingSaw_Types must be integrated into the project.

4.2 Structure of the LFlyingSaw library

4.2.1 LFlyingSaw_Blocks

Figure 4-1 LFlyingSaw_Blocks

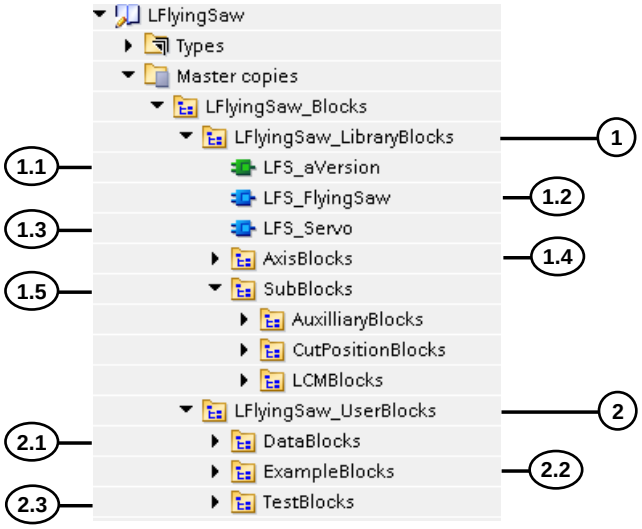


Table 4-2 LFlyingSaw_Blocks

No.	Description
1	**LFlyingSaw_LibraryBlocks** This folder contains all library relevant blocks to enable the standard application to function. The files in this folder structure should NOT be customized by the user
1.1	**LFS_aVersion** This block contains information of all already released versions
1.2	**LFS_FlyingSaw** Core block of the standard application "Flying Saw ", which was programmed for OB1 "Main"
1.3	**LFS_Servo** Core block of the standard application "Flying Saw", which was programmed for the cyclic call e.g. MC_PreServo.
1.4	**AxisBlocks** In this folder are all blocks to enable the communication of the application with the technology objects
1.5	**SubBlocks** This folder contains blocks which are instantiated by the above-mentioned blocks
2	**LFlyingSaw_UserBlocks** This folder contains blocks to control the standard application. The files in this folder structure may be customized by the user
2.1	**DataBlocks** This folder contains all instance blocks
2.2	**ExampleBlocks** This folder contains example blocks which have to be called in the organization blocks
2.3	**TestBlocks** This folder contains the sequence block for an example control of the application and communication with the HMI

4.2.2 LFlyingSaw_HMI

Figure 4-2 LFlyingSaw_ExampleHMI

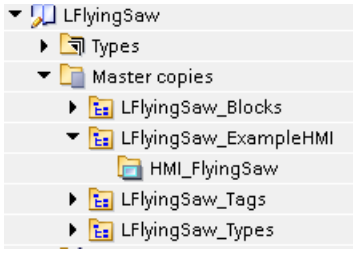


Table 4-3

No.	Description
1	**HMI_FlyingSaw** Example HMI project for FlyingSaw application

4.2.3 LFlyingSaw_Tags & _Types

Figure 4-3 LFlyingSaw_Tags &_Types

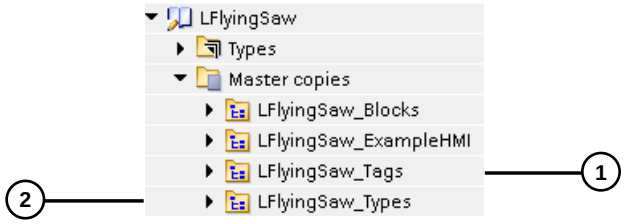


Table 4-4 LFlyingSaw_Tags and _Types

No.	Description
1	**LFlyingSaw_Tags** All constants of the standard application Flying Saw. More information in Datatypes and Tags
2	**LFlyingSaw_Types** All types of the standard application Flying Saw. Further information in Datatypes and Tags

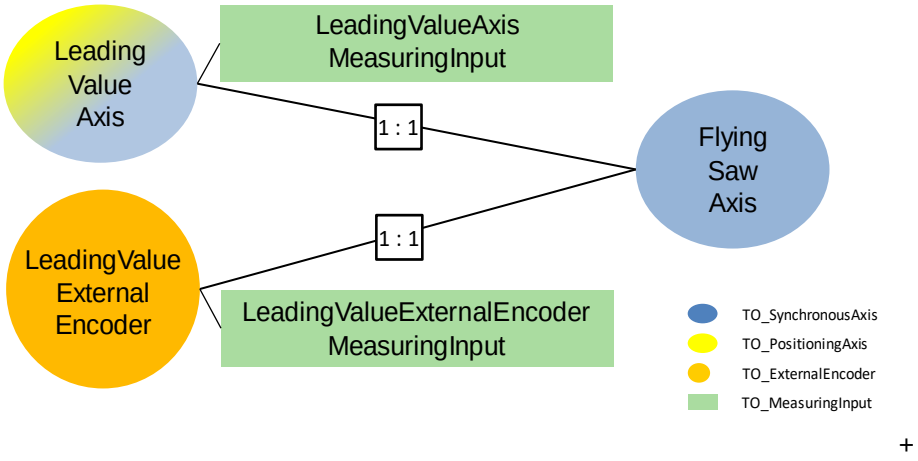
5 Preparation of the TO configuration

The standard SIMATIC Flying Saw application requires the following technology objects:

- For the FlyingSawAxis a **TO_SynchronousAxis**
- As leading value
  - Either a **TO_PositioningAxis** or **TO_SyncronousAxis (**with or without a **TO_MeasuringInput)**
  - Or a **TO_ExternalEncoder (**with or without a **TO_MeasuringInput)**

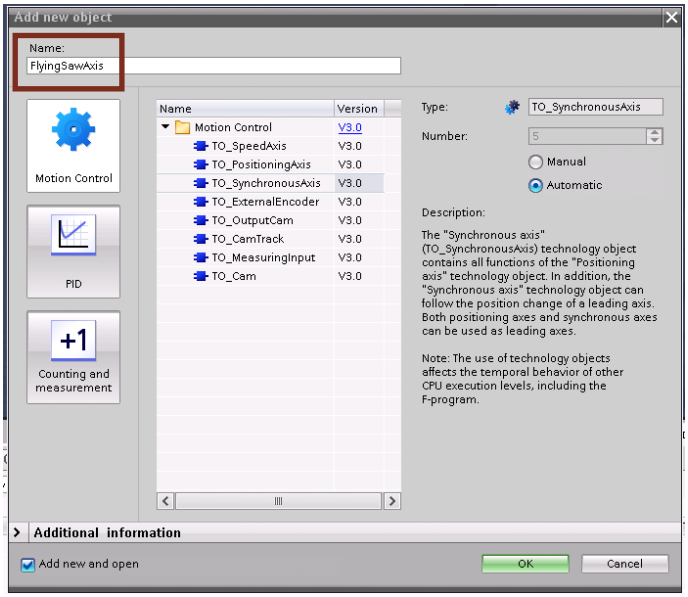
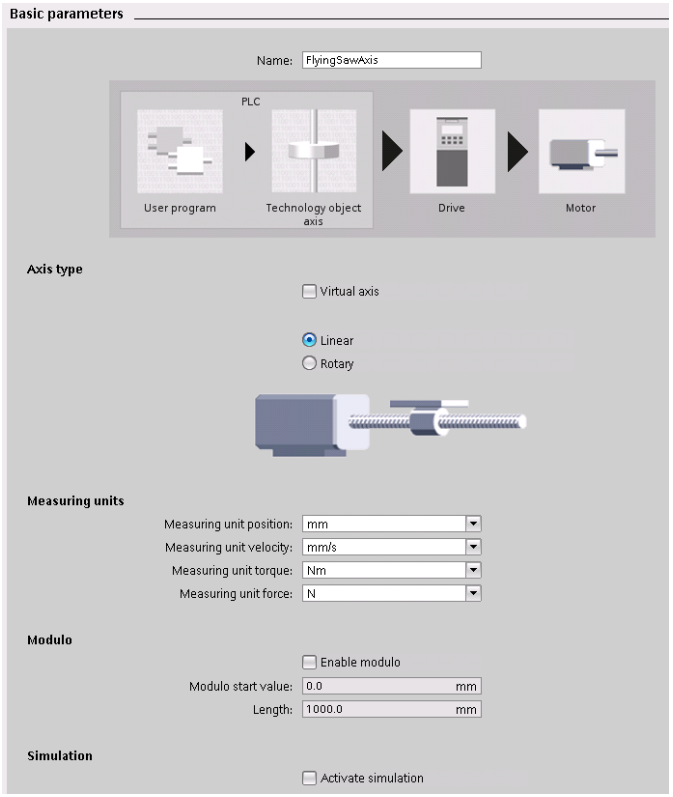
5.1 TO structure of the standard SIMATIC Flying Saw application

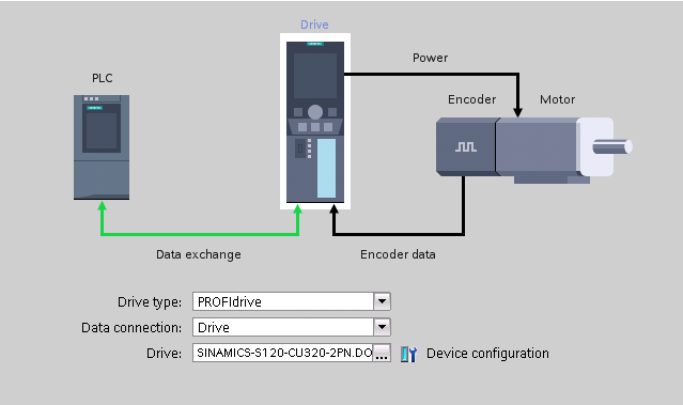
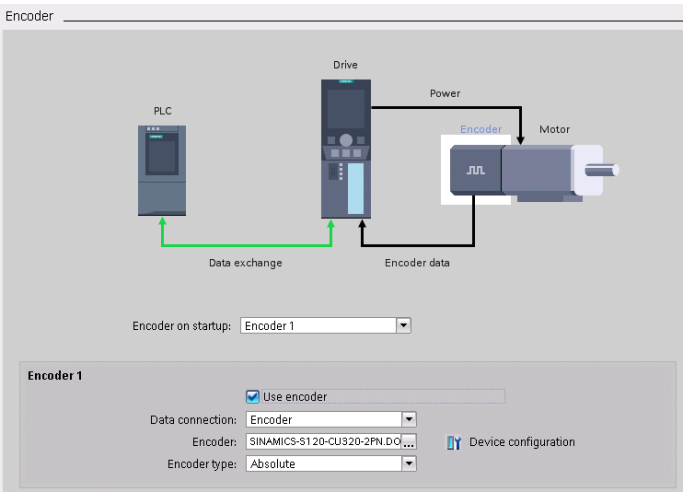
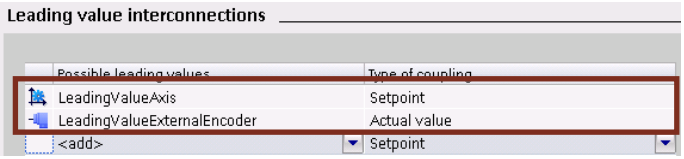
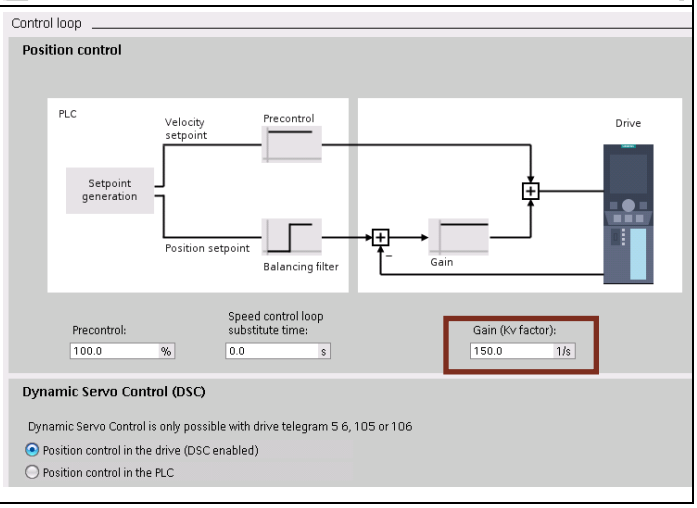
Fig. 5-1 TO configuration for the standard SIMATIC Flying Saw application

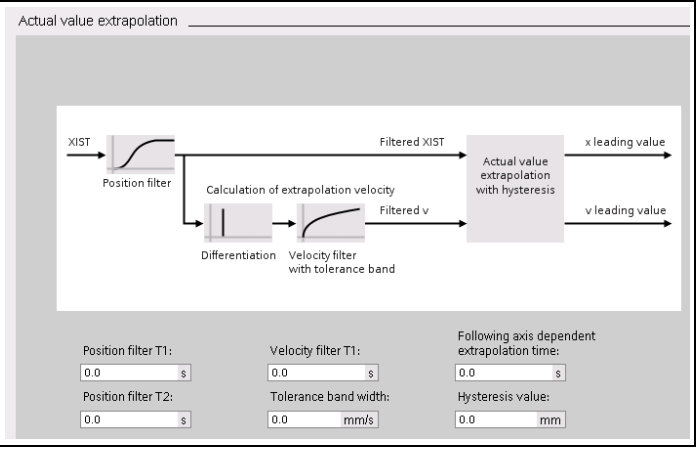


5.2 Configuring the TO FlyingSawAxis

Table 5-1 Configuring the TO FlyingSawAxis

1.	Insert a new TO_SynchronousAxis And enter the "FlyingSawAxis" name	
2.	Configure - Axis type - Dimension units - Modulo - Simulation For the FlyingSaw application it is important that axis type "linear" is selected. The dimension units have to be as used in the application mm and mm/s. It is not permissible that "Modulo" is activated as the FlyingSaw axis has a limited traversing range!	

3.	Here, the PROFIDrive drive of the FlyingSawAxis is assigned TO FlyingSawAxis	
4.	The settings for - Encoder - Data exchange, drive - Data exchange, encoder - Mechanical system - Dynamic response default setting - Emergency Stop - Position limits - Dynamic limits - Torque limiting - Fixed stop detection - Homing active/passive - Position monitoring - Standstill signal - Following error must all be carried out	
5.	Here, all the possible leading value interconnections must be entered with their associated coupling type.	
6.	The control parameters are set here. In conjunction with SINAMICS S120, a Pre-control = 100.0 % Speed control loop substitute time = 0.0 s should be set. The gain (Kv factor) should be set corresponding to the requirements of the application.	

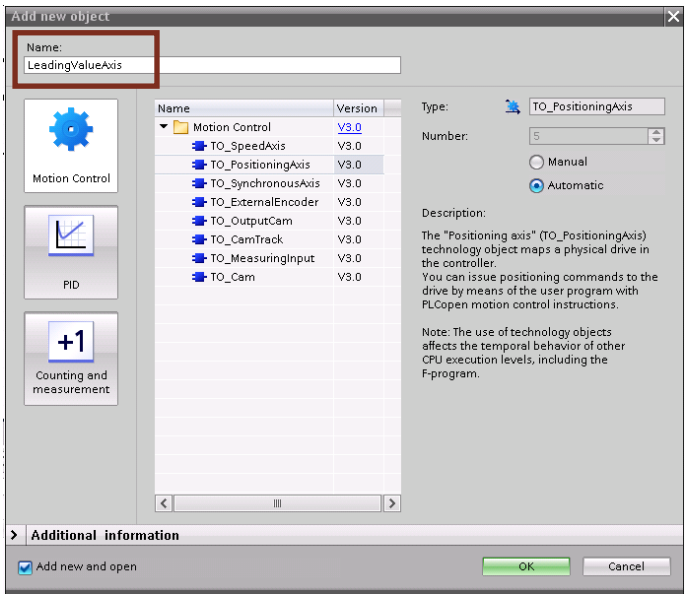
7.	Here, settings are not required, as the FlyingSawAxis is not used as leading value for an additional following axis with actual value coupling.	

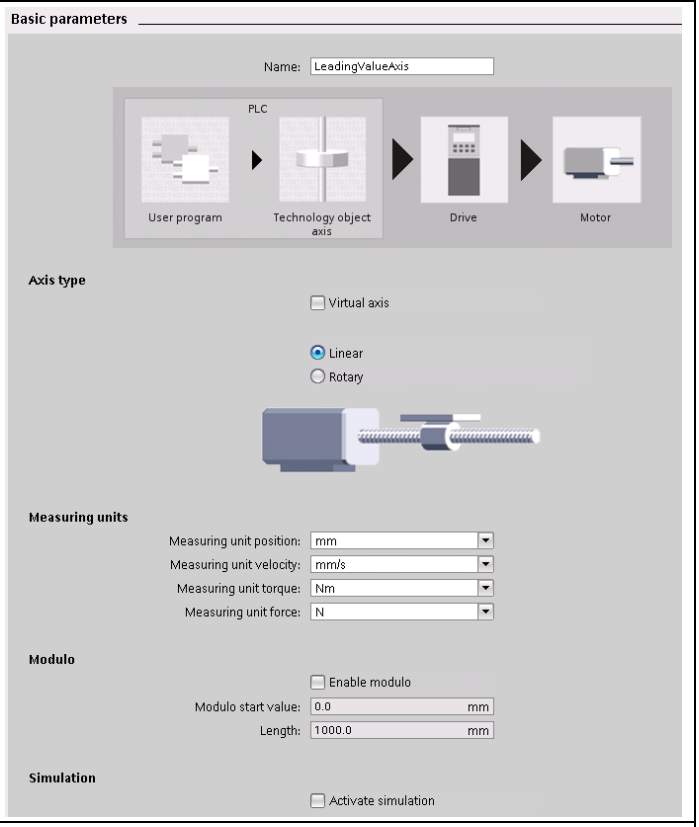
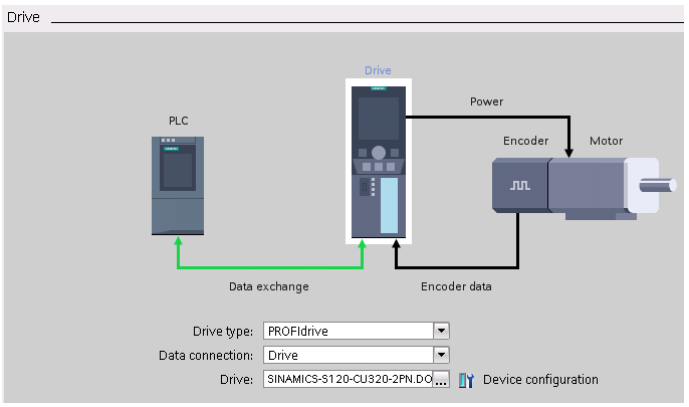
5.3 Configuring the leading value TO

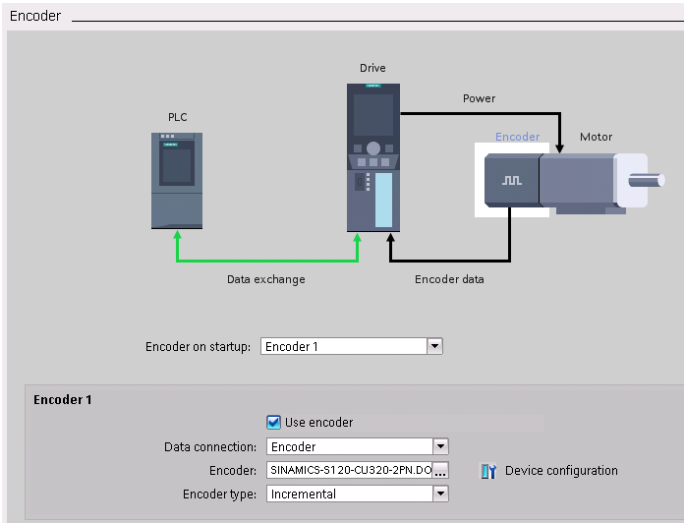
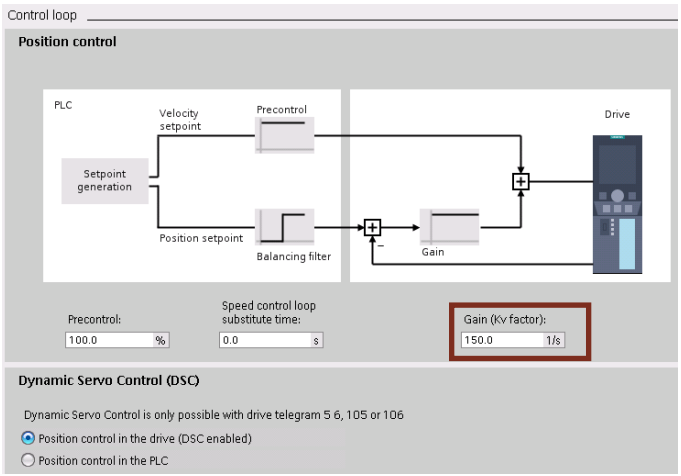
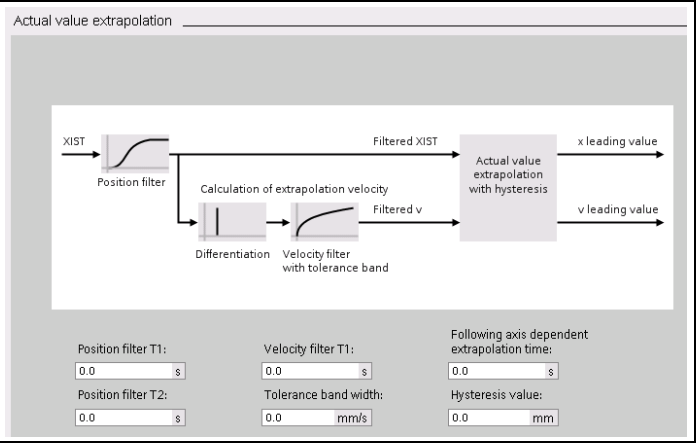
As leading value TO, you have the option of either accessing an axis – or an external encoder.

5.3.1 Configuring a axis as leading value

Table 5-2 Configuring TO LeadingValueAxis

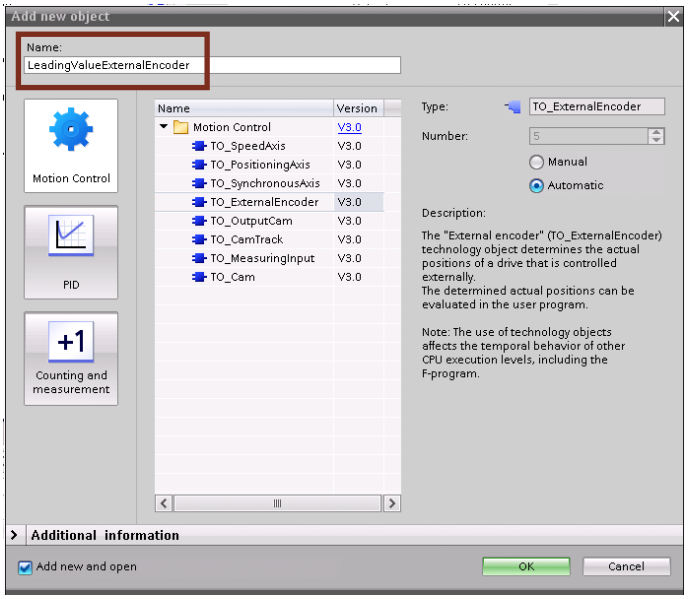
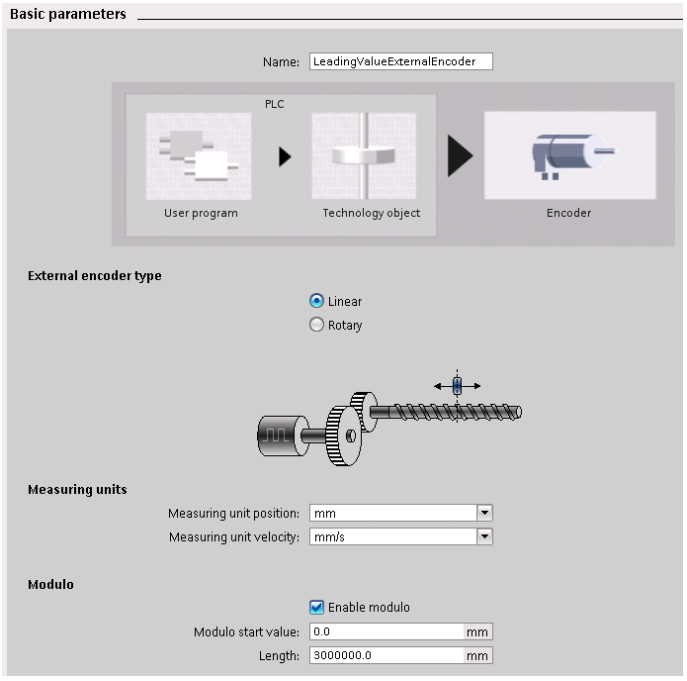
1.	Inserting a new TO_PositioningAxis or TO_SynchronousAxis And enter the "LeadingValueAxis" name	

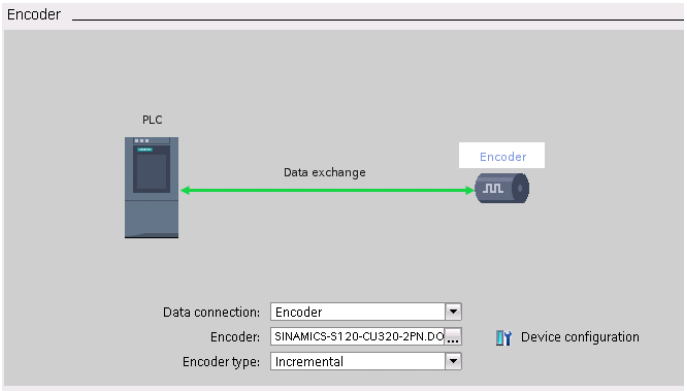
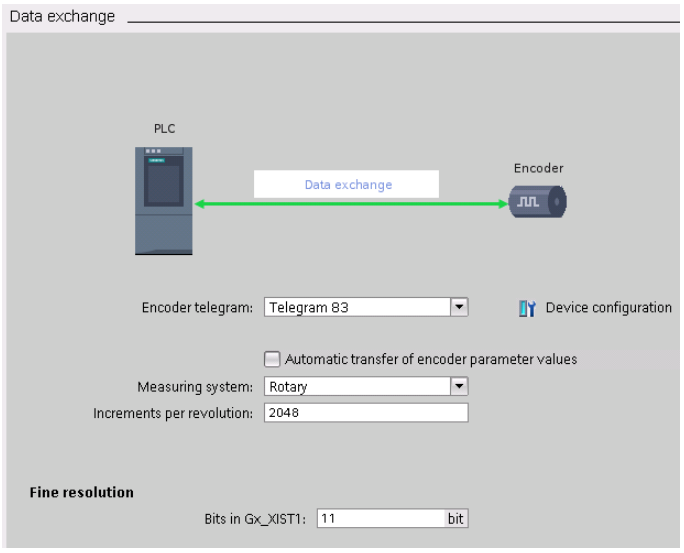
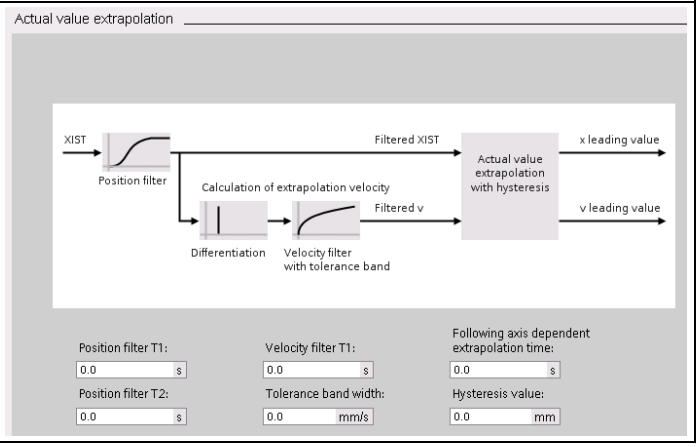
2.	Configure - Axis type - Dimension units - Modulo - Simulation For the Flying Saw application, it is important that axis type "linear" is selected. The dimension units can be mm or m with corresponding velocity unit. It is permissible that LeadingValueAxis is operated with or without modulo. If the axis is to be operated without modulo, it must be ensured that the axis is reset from time to time, as accuracy problems occur for excessively high values.	
3.	Here, the PROFIDrive drive of the LeadingValueAxis is assigned to TO LeadingValueAxis	

4.	The settings for - Encoder - Data exchange, drive - Data exchange, encoder - Mechanical system - Dynamic response default setting - Emergency Stop - Position limits - Dynamic limits - Torque limiting - Fixed stop detection - Homing active/passive - Position monitoring - Standstill signal - Following error must all be carried out	
5.	The control parameters are set here. In conjunction with SINAMICS S120, a Pre-control = 100.0 % Speed control loop substitute time = 0.0 s should be set. The gain (Kv factor) should be set corresponding to the requirements of the application.	
6.	In this case, settings should only be made if LeadingValueAxis is used as leading value of an actual value coupling. Entries are not required for a setpoint coupling!	

5.3.2 Configuring an external encoder as leading value

Table 5-3 Configuring the TO LeadingValueExternalEncoder

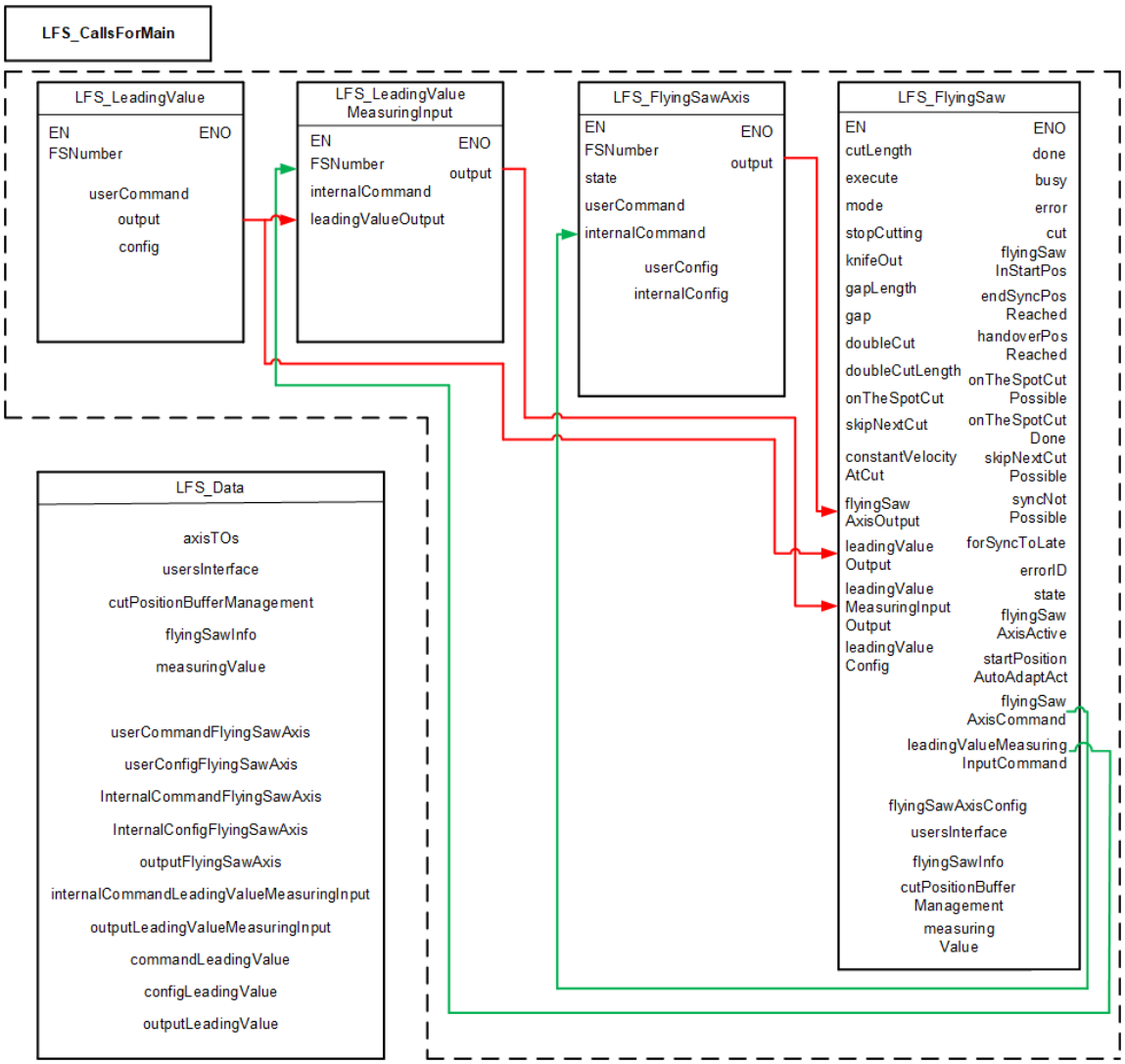
1.	Insert a new TO_ExternalEncoder And enter the "LeadingValue ExternalEncoder" name	
2.	Configure - Encoder type - Dimension units - Modulo For the Flying Saw application, it is important that encoder type "linear" is selected. The dimension units can be mm or m with corresponding velocity unit. It is permissible that the LeadingValue ExternalEncoder is operated with or without modulo. If the encoder is to be operated without modulo, it must be ensured that the axis is reset from time to time, as accuracy problems occur for excessively high values.	

3.	Here, the PROFIDrive encoder is assigned to TO LeadingValue ExternalEncoder	
4.	The settings for - Encoder - Data exchange - Mechanical system - Homing must all be carried out	
5.	This screen form is automatically populated. Adaptations can be made here if problems are encountered with the actual value coupling.	

6 Description of the blocks and their structure

6.1 “LFS_CallsForMain” structure

Figure 6-1 LFS_CallsForMain structure



6.2 LFS_FlyingSaw

Block name

LFS_FlyingSaw

Task

Control block of the SIMATIC Flying Saw application. The block includes the following functions:

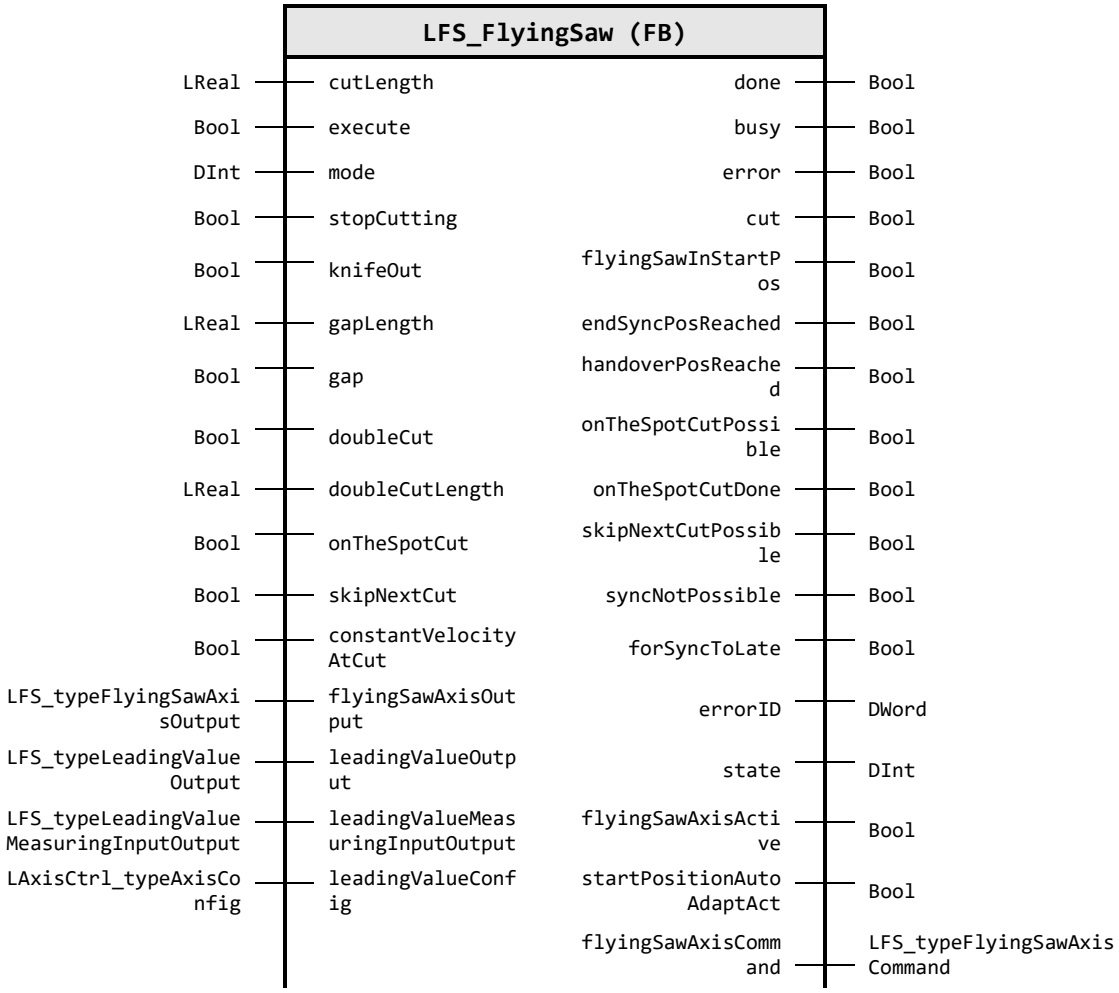
- Operating mode manager of the application, including operating modes ERROR, DISABLE, MANUAL, STARTPOSITION, AUTOMATIC
- Determining the cut position – either based on a print mark and sensor or a cut length that can be parameterized
- Synchronizing to the material web
- During synchronous travel, controlling the cutting equipment
- Possibility of "Creating a gap"

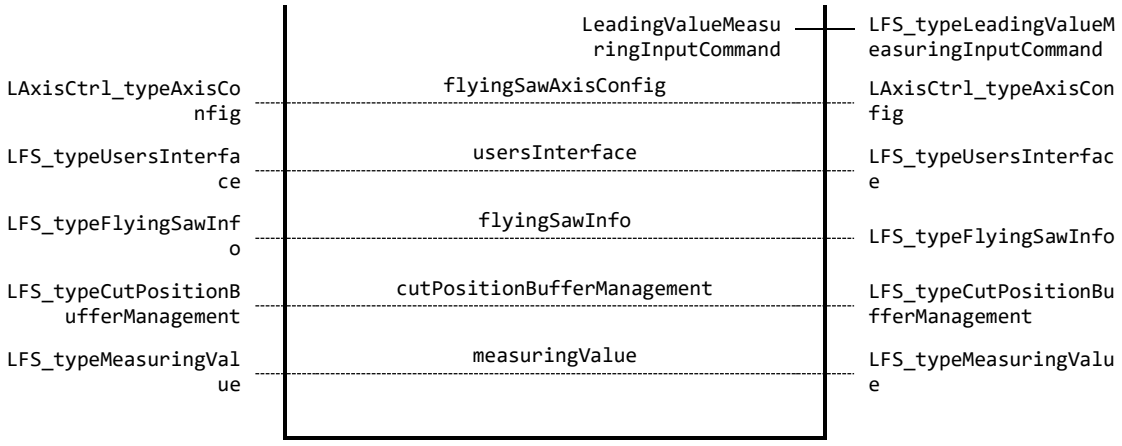
Integration into the execution system

The function block can be called in every cyclic OB. Users must integrate the block.

Interface description

Block Interface





Input parameter

Identifier	Data type	Default value	Description
cutLength	LReal	800.0	[mm] format length
execute	Bool	FALSE	Activates the mode of operation switchover with the operating mode specified in “Mode”.
mode	DInt	0	[-] Using mode, the mode is preselected, which is activated with the next positive edge at the execute input
stopCutting	Bool	FALSE	Cutting has been finished
knifeOut	Bool	FALSE	Tool is out of material
gapLength	LReal	10.0	[mm] Length of the gap
gap	Bool	FALSE	Move a gap afterwards a cut
doubleCut	Bool	FALSE	Activate double cut
doubleCutLength	LReal	100.0	[mm] Length of double cut
onTheSpotCut	Bool	FALSE	Activate on the spot cut
skipNextCut	Bool	FALSE	Skip next cut
constantVelocityAtCut	Bool	FALSE	Assume constant leading value velocity during synchronous phase
flyingSawAxisOutput	LFS_typeFlyingSawAxisOutput	---	This structure contains all the required feedback signals of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisOutput
leadingValueOutput	LFS_typeLeadingValueOutput	---	This structure contains all the required feedback signals of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisOutput
leadingValueMeasuringInputOutput	LFS_typeLeadingValueMeasuringInputOutput	---	This structure contains all the required feedback signals of the measuring input at the leading value. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueMeasuringInputOutput
leadingValueConfig	LAxisCtrl_typeAxisConfig	---	

Output parameter

Identifier	Data type	Description
done	Bool	TRUE: Selected mode is activated
busy	Bool	TRUE: Operating mode switchover is active
error	Bool	TRUE: Displays an error within the FBs or at the flying saw axes. Details see errorID.
cut	Bool	TRUE: FlyingSaw is in synchronous Phase
flyingSawInStartPos	Bool	TRUE: FlyingSaw stands in its startposition
endSyncPosReached	Bool	TRUE: FlyingSaw has reached the end of synchornous range
handoverPosReached	Bool	TRUE: FlyingSaw has reached the handover position
onTheSpotCutPossible	Bool	TRUE: On the spot cut is possible
onTheSpotCutDone	Bool	TRUE: On the spot cut has been done
skipNextCutPossible	Bool	TRUE: Skip next cut is possible
syncNotPossible	Bool	TRUE: Synchronization is not possible, because upper limit for starting synchronization was overrun in automatic state "AR_GEARIN_FSA_ABSOLUTE" or "AR_GEARIN_FSA_RELATIVE" before starting synchronization
forSyncToLate	Bool	TRUE: Synchronization is not possible, because upper limit for starting synchronization was overrun in automatic state "AR_WAIT_FOR_FLYING_SAW_START" or "AR_POS_STARTPOS_NEXT_START" before starting synchronization
errorID	DWord	Error code. The ErrorIDs are described in this document.
state	DInt	[-] Active mode: LFS_OM_ERROR (0): ERROR mode LFS_OM_DISABLE (1): DISABLE mode LFS_OM_START_POSITION (2): STARTPOSITION mode LFS_OM_AUTOMATIC (3): AUTOMATIC mode LFS_OM_MANUAL (4): MANUAL mode LFS_OM_NOTHING_SELECTED (8): No mode change LFS_OM_CHANGING (9): Mode change active
flyingSawAxisActive	Bool	TRUE: FlyingSaw axis is enabled
startPositionAutoAdaptAct	Bool	TRUE: Automatic adapting of startposition is active
flyingSawAxisCommand	LFS_typeFlyingSawAxisCommand	This structure contains the command interface to the axis FB, reduced to the requirements of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisCommand

Identifier	Data type	Description
LeadingValueMeasuringInputCommand	LFS_typeLeadingValueMeasuringInputCommand	This structure contains the command interface to the axis FB, reduced to the requirements of the measuring input. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueMeasuringInputCommand

In/Out parameter

Identifier	Data type	Description
flyingSawAxisConfig	LAxisCtrl_typeAxisConfig	
usersInterface	LFS_typeUsersInterface	This structure contains the interface for the user to enter physical conditions, dynamics and FlyingSaw behaviour. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeUsersInterface
flyingSawInfo	LFS_typeFlyingSawInfo	This structure contains the internal data area to display actual l values, actual cut position as well as binary signals for the FlyingSaw position. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawInfo
cutPositionBufferManagement	LFS_typeCutPositionBufferManagement	This structure contains the internal data area for entering precise cut position for the print mark cutting. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeCutPositionBufferManagement
measuringValue	LFS_typeMeasuringValue	This structure contains the internal measuring data area for the print mark cutting. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeMeasuringValue

Functionality

Function block *LFS_**FlyingSaw*** is the most important application element. The connected flying saw is parameterized and controlled using this block.

Initial state of LFS_FlyingSaw

After the initialization, *LFS_**FlyingSaw*** is in the DISABLE mode.

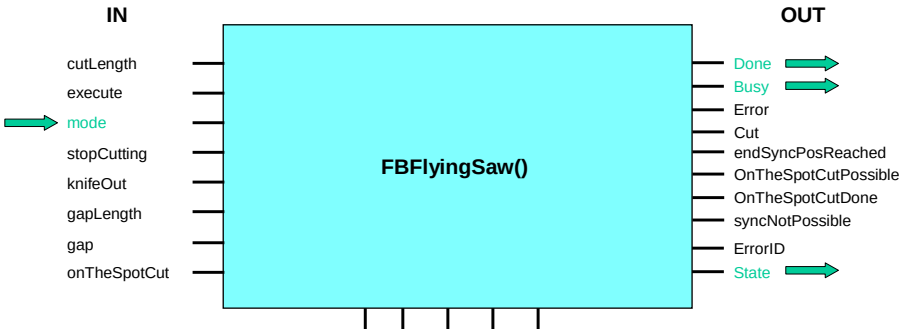
Each time the control starts, the initialization must be executed by setting the restart bit *("LFS_Data".flyingSaw[0].usersInterface.restart*) in the Start Up task. (This is realized automatically when using the *LFS_CallsForStartup* block)

Therefore, the block is transitioned into its basic state, important parameters are subject to a plausibility check, if possible, adapted – and parameterizing errors are displayed at the error output to inform users.

Sequence when switching over operating modes

The actual block operating mode is indicated at output **state**.

Fig. 6-2: Inputs and outputs of the operating mode switchover function



Transition of the operating modes

To transition the operating mode, the number of the required operating mode must be specified at the input **mode**. The switchover is realized by using a rsing edge at the input **execute**. The active switchover to the new block operating mode is signaled using a high signal at output ***busy***. If all switchover actions are successfully performed, and the new operating mode is reached, this is indicated by a high signal at output ***done*** of the block. The number of the new operating mode can be read at output ***state***.

Checking the input parameters and parameterizing the mandatory technology settings

This program function is only executed after a "new start" – or if it is activated by the user using the restart bit of *UsersInterface*.

The following are monitored:

- The existence and drive interconnection of the specified TOs.
- Deviations with respect to what has been specified are displayed as error messages

Axis monitoring

The function block is switched into the error state (ERROR mode) if errors occur at the technology object axis of the flying saw.

However, the monitoring is only active if the parameterization of the technology objects has been successfully checked.

Using the restart bit

("LFS_Data".flyingSaw[0].usersInterface.restart)

Each time the SIMATIC starts or when changing the parameterization, then the restart bit must be set. Therefore, an initialization routine as well as a parameter check is performed in *LFS_**FlyingSaw***, and the block is brought into a defined state.

Note

We recommend that the example FC LFS_CallsForStartup provided is used and called in an OB StartUp to initialize block *LFS_FlyingSaw*.

The restart bit should also be set there so that the block is brought into a defined state!

Note

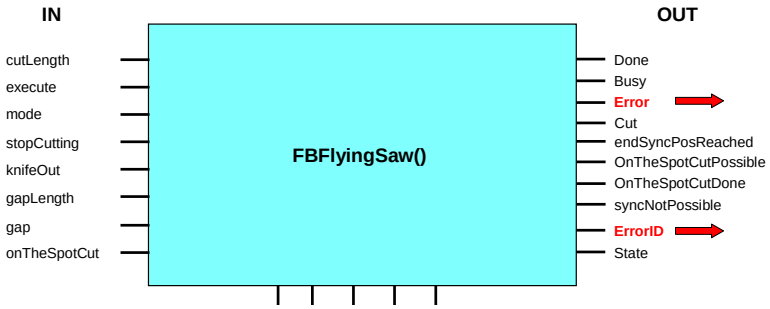
After restart, the block checks the essential parameters of the technology as well as the existence of technology objects that have been saved.

After the block has been successfully initialized, the block is automatically reset again.

Error handling

If, during operation of the *LFS_FlyingSaw*, errors occur in the block itself or at the technology objects and technology functions involved, then these are signaled at the ***error*** and ***errorID*** block outputs.

Fig. 6-3: Block outputs for error messages



The ***error*** signals an active error, while an error code is output at e**rrorID**; this can be used to analyze the cause of the error. All possible errors are described in this document.

6.3 LFS_Servo

Block name

LFS_Servo

Task

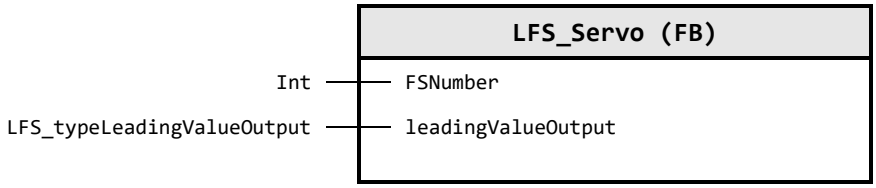
- Reading of all relevant axis data used in servo clock. Calculation of precision of cut length using two following cuts.
- Detection and presetting of velocity at "Constant Velocity at Cut"

Integration into the execution system

The function block must be called in OB MC-PreServo. Users must integrate the block.

Interface description

Block Interface



Input parameter

Identifier	Data type	Default value	Description
FSNumber	Int	0	Number of FlyingSaw instance
leadingValueOutput	LFS_typeLeadingValueOutput	---	This structure contains all the required feedback signals of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisOutput

6.4 Axis Blocks

6.4.1 LFS_FlyingSawAxis

Control block of the flying saw Axis

Block name

LFS_FlyingSawAxis

Task

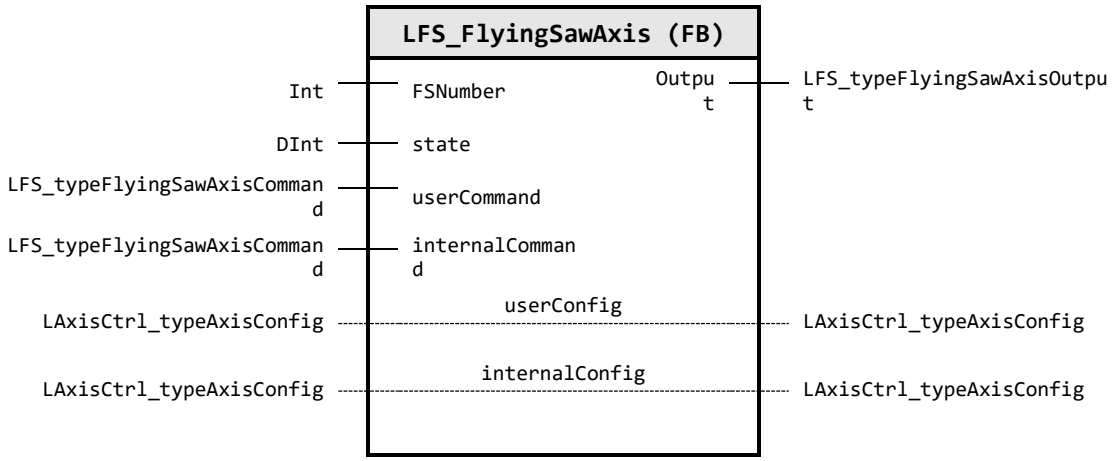
Controlling the flying saw axis by calling axis FB functions.

Integration into the execution system

The function block must be called in a cyclic OB. (Standard: OB1)

Interface description

Block Interface



Input parameter

Identifier	Data type	Default value	Description
FSNumber	Int	0	Number of FlyingSaw instance
state	DInt	0	[-] Active mode: LFS_OM_ERROR (0): ERROR mode LFS_OM_DISABLE (1): DISABLE mode LFS_OM_START_POSITION (2): STARTPOSITION mode LFS_OM_AUTOMATIC (3): AUTOMATIC mode LFS_OM_MANUAL (4): MANUAL mode LFS_OM_NOTHING_SELECTED (8): No mode change LFS_OM_CHANGING (9): Mode change active
userCommand	LFS_typeFlyingSawAxisCommand	---	This structure contains the command interface to the axis FB, reduced to the requirements of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisCommand

Identifier	Data type	Default value	Description
internalCommand	LFS_typeFlyingSawAxisCommand	---	This structure contains the command interface to the axis FB, reduced to the requirements of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisCommand

Output parameter

Identifier	Data type	Description
Output	LFS_typeFlyingSawAxisOutput	This structure contains all the required feedback signals of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisOutput

In/Out parameter

Identifier	Data type	Description
userConfig	LAxisCtrl_typeAxisConfig	
internalConfig	LAxisCtrl_typeAxisConfig	

Functionality

- This block controls the active call interface for the axis FB of the FlyingSawAxis, as a function of the operating mode of the FlyingSaw block.
- In the "Manual" mode (state = LFS_OM_MANUAL(4)), the axis of the FlyingSawAxis is called with the user command interface (userCommand) and the user configuration data (userConfig). Therefore, in this mode users have unrestricted access to the Flying Saw axis.
- In all other operating modes (state = LFS_OM_ERROR(0), LFS_OM_DISABLE(1), LFS_OM_START_POSITION(2) and LFS_OM_AUTOMATIC(3)), the axis FB of the FlyingSawAxis is called with the internal command interface (internalCommand) and the internal configuration data (internalConfig). In these modes, the Flying Saw axis is exclusively accessed using the standard "Flying Saw" application.

Error messages

The block does not generate any error messages.

6.4.2 LFS_LeadingValue

Control block of the leading value axis

Block name

LFS_LeadingValue

Task

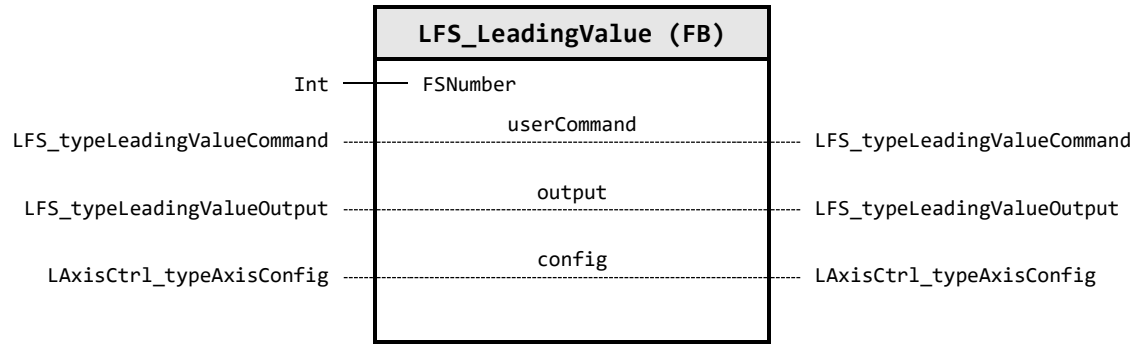
- Identification whether axis or external encoder is interconnected as leading value
- Switch between different leading values
- Controlling the leading value axis by calling the axis FB functions via the user interface
- Reading out all the leading value data relevant for LFS_FlyingSaw

Integration into the execution system

The function block must be called in a cyclic OB. (Standard: OB1)

Interface description

Block Interface



Input parameter

Identifier	Data type	Default value	Description
FSNumber	Int	0	Number of FlyingSaw instance

In/Out parameter

Identifier	Data type	Description
userCommand	LFS_typeLeadingValueCommand	This structure contains the command interface to the axis FB, reduced to the requirements of the leading value. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueCommand
output	LFS_typeLeadingValueOutput	This structure contains all the required feedback signals of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisOutput
config	LAxisCtrl_typeAxisConfig	

Functionality

- Provision of the axis FB interface to operate the axis as leading value for the user.
- Provision of all the relevant axis data as leading value for the FlyingSaw block.
- Switch between different leading values by access to an array of leading values up to “LFS_MAX_NUMBER_OF_LEADING_VALUES” number of elements.
- Possible leading values:
  - TO SynchronousAxis
  - TO PositioningAxis
  - TO ExternalEncoder

Error messages

The block does not generate any error messages.

6.4.3 LFS_LeadingValueMeasuringInput

Control block of the leading value measuring Input

Block name

LFS_LeadingValueMeasuringInput

Task

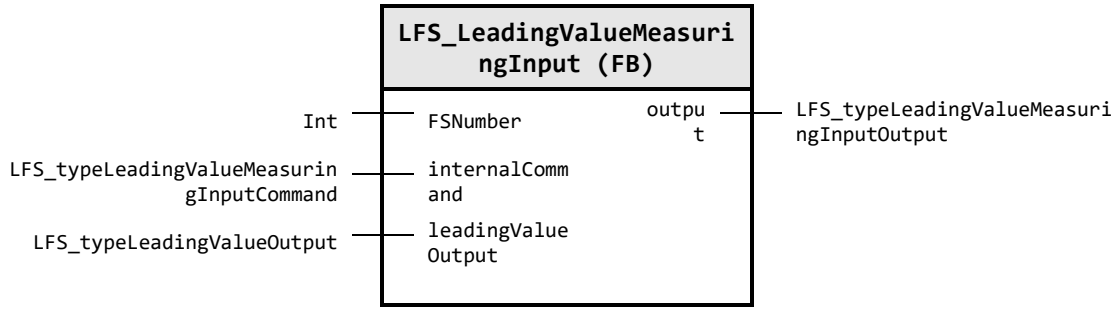
Controlling the leading value measuring Input by calling PLC open blocks MC_RESET and MC_MEASURINGINPUT.

Integration into the execution system

The function block must be called in a cyclic OB.
(Standard: OB1)

Interface description

Block Interface



Input parameter

Identifier	Data type	Default value	Description
FSNumber	Int	0	Number of FlyingSaw instance
internalCommand	LFS_typeLeadingValueMeasuringInputCommand	---	This structure contains the command interface to the axis FB, reduced to the requirements of the measuring input. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueMeasuringInputCommand
leadingValueOutput	LFS_typeLeadingValueOutput	---	This structure contains all the required feedback signals of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisOutput

Output parameter

Identifier	Data type	Description
output	LFS_typeLeadingValueMeasuringInputOutput	This structure contains all the required feedback signals of the measuring input at the leading value. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueMeasuringInputOutput

Functionality

- Calling of the sensor functions by the FlyingSaw block via internal command interface.
- Providing of all the relevant sensor data at the leading value for the FlyingSaw block.

Error messages

The block does not generate any error messages.

7 Description of the data and their structure

7.1 Overview

Enumeration types

Enumeration type declarations are provided for some of the input and output parameters of the function blocks. Various modes and properties can be set using these parameters.

Data structures

In some instances, the function blocks of the SIMATIC Flying Saw application are parameterized using data structures, which should be created for the block. Structures with the appropriate parameters are available for each block.

7.2 Enumeration types

Table 7-1 Enumeration types, declared in LFLyingSaw_Tags

Name of the enumeration type	Content
LFS_Constant_CalcProfile_Errors	This enumeration type contains constants for errors which are internally used for calculating profiles. Not interesting for user. Because of this there is no description in manual.
LFS_Constant_ErrorIDs	This enumeration type defines the value of all possible ErrorIDs (errors, warnings)
LFS_Constant_Operating	This enumeration type contains DINT constants to select and display the operating and functionality of function block LFS_FlyingSaw
LFS_Constant_UnitConversion	This enumeration type contains UDINT constants for the TIA Portal TO length and velocity unit number for calculating the unit conversion factors.
LFS_Constant_UserConfig	This enumeration contains constants which have to be adapted by the user to specific values of the machine.

7.2.1 LFS_Constant_CalcProfile_Errors

Constant identifier, values and description

Identifier & Value	Description
LCM_ERR_ACCELERATION_OUT_OF_BOUNDS 116	
LCM_ERR_DECELERATION_OUT_OF_BOUNDS 117	
LCM_ERR_JERK_OUT_OF_BOUNDS 113	
LCM_ERR_NEGATIVE_RESULT 111	
LCM_ERR_NOT_SOLVABLE 114	
LCM_ERR_VELOCITY_OUT_OF_BOUNDS 115	
LCM_ERR_WRONG_ACCEL_ARGUMENT 100	
LCM_ERR_WRONG_ACCEL_LIMIT_ARGUMENT 101	
LCM_ERR_WRONG_DECEL_ARGUMENT 102	
LCM_ERR_WRONG_DISTANCE_ARGUMENT 103	
LCM_ERR_WRONG_JERK_ARGUMENT 104	
LCM_ERR_WRONG_MODE_ARGUMENT 118	
LCM_ERR_WRONG_TIME_ARGUMENT 106	
LCM_ERR_WRONG_VELOCITY_ARGUMENT 107	
LCM_MINJERK_TOLERANCE 1.0e-6	
LCM_MODE_DIRECTION_RELATED 173	
LCM_MODE_STATE_RELATED 91	

7.2.2 LFS_Constant_ErrorIDs

Constant identifier, values and description

Identifier & Value	Description
LFS_ERR_ACT_POS_BIGGER_THAN_END_POS 16#060A_8002	Actual position of the axis of the flying saw > usersInterface.EndPos
LFS_ERR_AR_DOUBLECUT 16#0603_8009	Error when activating MC_OFFSETRELATIVE or MC_MOVESUPERIMPOSED during automatic run state DOUBLE CUT
LFS_ERR_AR_GEARIN_FSA_ABSOLUTE 16#0603_8003	Error when activating MC_GEARINPOS during automatic run
LFS_ERR_AR_GEARIN_FSA_RELATIVE 16#0603_8002	Error when activating MC_GEARIN during automatic run
LFS_ERR_AR_MOVE_GAP 16#0603_8004	Error when activating MC_MOVESUPERIMPOSED during automatic run
LFS_ERR_AR_ON_SPOT_CUT_LV_POS_LOWER_THAN_FS_START_POS 16#0603_8007	On the spot cut at standstill selected, but material position is lower than start position of flying saw. Therefore, material is not under flying saw, cut into void
LFS_ERR_AR_POS_STARTPOS_NEXT_START 16#0603_8006	Error when activating MC_MOVEABSOLUTE during automatic run state POS STARTPOS NEXT START
LFS_ERR_AR_STOP_FSA 16#0603_8005	Error when activating MC_HALT during automatic run
LFS_ERR_AR_SYNC_POS_LOWER_THAN_START_POS 16#0603_8008	Wrong parameterization: 0.0 < UsersInterface.SyncPos < UsersInterface.StartPos
LFS_ERR_AR_WAIT_FOR_FLYING_SAW_START 16#0603_8001	Error when activating MC_MOVEABSOLUTE during automatic run state WAIT FOR FLYING SAW START
LFS_ERR_AT_FS_AXIS 16#060A_8001	Error at TO of flying saw axis
LFS_ERR_AUTOMATIC_TO_DISABLE 16#0631_8001	Error when activating MC_HALT during mode change AUTOMATIC to DISABLE
LFS_ERR_AUTOMATIC_TO_STARTPOSITION 16#0632_8001	Error when activating MC_MOVEABSOLUTE during mode change AUTOMATIC to STARTPOSITION

Identifier & Value	Description
LFS_ERR_DISABLE_TO_DISABLE 16#0611_8001	Error when activating MC_HALT during mode change DISABLE to DISABLE
LFS_ERR_DISABLE_TO_STARTPOSITION 16#0612_8001	Error when activating MC_MOVEABSOLUTE during mode change DISABLE to STARTPOSITION
LFS_ERR_INAVLID_MODE_AFTER_AUTOMATIC_MODE 16#060F_8004	Invalid mode after mode AUTOMATIC selected
LFS_ERR_INAVLID_MODE_AFTER_DISABLE_MODE 16#060F_8002	Invalid mode after mode DISABLE selected
LFS_ERR_INAVLID_MODE_AFTER_ERROR_MODE 16#060F_8001	Invalid mode after mode ERROR selected
LFS_ERR_INAVLID_MODE_AFTER_MANUAL_MODE 16#060F_8005	Invalid mode after mode MANUAL selected
LFS_ERR_INAVLID_MODE_AFTER_STARTPOSTION_MODE 16#060F_8003	Invalid mode after mode STARTPOSITION selected
LFS_ERR_LV_INVALID_LENGTH_OR_VELOCITY_UNIT 16#060A_8003	Invalid length or velocity unit at leading value TO
LFS_ERR_MANUAL_TO_DISABLE 16#0641_8001	Error when activating MC_HALT during mode change MANUAL to DISABLE
LFS_ERR_MANUAL_TO_STARTPOSITION 16#0642_8001	Error when activating MC_MOVEABSOLUTE during mode change MANUAL to STARTPOSITION
LFS_ERR_MODULO_LENGTH_EQUAL_ZERO_MODE 16#060C_8004	Modulo at leading value active, but length is 0.0
LFS_ERR_OM_CHANGE_DURING_INTERRUPT_PRODUCTION 16#0603_8010	Mode change with active production interrupted. Before the change, production continued is necessary.
LFS_ERR_STARTPOSITION_TO_DISABLE 16#0621_8001	Error when activating MC_HALT during mode change STARTPOSITION to DISABLE
LFS_ERR_STARTPOSITION_TO_STARTPOSITION 16#0622_8001	Error when activating MC_MOVEABSOLUTE during mode change STARTPOSITION to STARTPOSITION
LFS_ERR_TO_MISSING_FOR_FS 16#060C_8001	No TO connected to flying saw axis
LFS_ERR_TO_MISSING_FOR_LV 16#060C_8002	No TO connected to leading value axis
LFS_ERR_TO_MISSING_FOR_MI 16#060C_8003	No TO measuring input connected to leading value
LFS_NO_ERROR 16#0000_0000	No error

Identifier & Value	Description
LFS_WAR_FIRST_CUT_LENGTH_POSSIBLY_WRONG 16#0603_4001	First cut after immediate cut at standstill and leading value at the external encoder is still in acceleration phase. First cut length possibly wrong

7.2.3 LFS_Constant_Operating

Constant identifier, values and description

Identifier & Value	Description
LFS_BY_LEADING_AXIS_VALUE 2	Synchronization by distance. The distance is saved in variable "usersInterface.SyncPos"
LFS_BY_TIME 1	Synchronization by time
LFS_CP_CALCULATED 2	Cut position remains constant, the material position is reduced by the cut length after the cut (the amount cutoff). This procedure does not require any stored position data.
LFS_CP_MEASURED 1	Cut position is measured using the sensor and print mark or calculated, and then entered into the CutPositionBuffer
LFS_CPM_DETECTED 1	Cut position is measured using the sensor and print mark
LFS_CPM_SIMULATED 2	Cut position is calculated from the specified cut length
LFS_MOVE_ZERO_POS 1	Flying saw directly returns to the start position
LFS_OM_AUTOMATIC 3	LFS_FlyingSaw is in the AUTOMATIC mode
LFS_OM_CHANGING 6	LFS_FlyingSaw is presently undergoing a mode change
LFS_OM_DISABLE 1	LFS_FlyingSaw is in the DISABLE mode
LFS_OM_ERROR 0	LFS_FlyingSaw is in the ERROR mode
LFS_OM_MANUAL 4	LFS_FlyingSaw is in the MANUAL mode
LFS_OM_NOTHING_SELECTED 5	LFS_FlyingSaw has not detected a mode change
LFS_OM_START_POSITION 2	LFS_FlyingSaw is in the STARTPOSITION mode
LFS_RUN_HANDOVER_POS 2	Flying saw first returns to the transfer position – and then to the start position
LFS_SYMMETRIC 3	Synchronization is symmetrical without velocity overshoot

7.2.4 LFS_Constant_UnitConversion

Constant identifier, values and description

Identifier & Value	Description
LFS_LENGTH_UNIT_M 1010	Length unit of TO is m
LFS_LENGTH_UNIT_MM 1013	Length unit of TO is mm
LFS_LENGTH_UNIT_MM_HIGH_RESOLUTION 1536	Length unit of TO is mm with high resolution
LFS_VELOCITY_UNIT_M_PER_H 1063	Velocity unit of TO is m/h
LFS_VELOCITY_UNIT_M_PER_MIN 1525	Velocity unit of TO is m/min
LFS_VELOCITY_UNIT_M_PER_S 1061	Velocity unit of TO is m/s
LFS_VELOCITY_UNIT_MM_PER_H 1526	Velocity unit of TO is mm/h
LFS_VELOCITY_UNIT_MM_PER_MIN 1524	Velocity unit of TO is mm/min
LFS_VELOCITY_UNIT_MM_PER_S 1062	Velocity unit of TO is mm/s
LFS_VELOCITY_UNIT_MM_PER_S_HIGH_RESOLUTION 1538	Velocity unit of TO is mm/s with high resolution

7.2.5 LFS_Constant_UserConfig

Constant identifier, values and description

Identifier & Value	Description
LFS_CPB_MAX-1 4	Maximum length of CutPosition Buffer - 1
LFS_DELTA_STARTPOS 3.0	Range in which FlyingSaw is in Startposition
LFS_MAX_NUMBER_OF_FLYING_SAWS-1 0	Maximum number of flying saws - 1
LFS_MAX_NUMBER_OF_LEADING_VALUES 3	Maximum number of leading values
LFS_NUMBER_OF_FLYING_SAWS 1	Number of FlyingSaw axes
LFS_START_AREA 20.0	Range for starting the synchronization
LFS_START_SYNC_WAITING_DISTANCE 10.0	Safety distance to begin with synchronization at the latest practiable date
LFS_STATEVAL_MAX_BUFFERLENGTH 50	Maximum buffer length for average calculating of leading vcalue velocity

7.3 Data types

Data structure

Overview of the LFS_FlyingSaw data types and structure. Each data type is explained in detail below.

Name of the structure	Content
LFS_typeAutoCutting	This structure contains all data required to simulate a cut in conjunction with flying saw application. Declared in: LFlyingSaw_Types/LFS_typeAutoCutting
LFS_typeAxisTOs	This structure contains all in FlyingSaw application required TOs using datatype DB_ANY. Declared in: LFlyingSaw_Types/LFS_typeAxisTOs
LFS_type CutPositionBuffer	This structure contains the memory in which the cut positions with the associated position deviations are saved. Declared in: LFlyingSaw_Types/LFS_typeCutPositionBuffer
LFS_type CutPositionBufferManagement	This structure contains the internal data area for entering precise cut position and cut position deviation for the print mark correction. Declared in: LFlyingSaw_Types/LFS_typeCutPositionBufferManagement
LFS_typeFlyingSaw	This structure contains the complete global data of the SIMATIC Flying Saw application. Declared in: LFlyingSaw_Types/LFS_typeFlyingSaw
LFS_type FlyingSawAxisCommand	This structure contains the command interface to the axis FB, reduced to the requirements of the FlyingSawAxis. Declared in: LFlyingSaw_Types/LFS_typeFlyingSawAxisCommand
LFS_type FlyingSawAxisOutput	This structure contains all the required feedback signals of the FlyingSawAxis. Declared in: LFlyingSaw_Types/LFS_typeFlyingSawAxisOutput
LFS_type FlyingSawAxisServoValues	This structure contains all the required feedback signals of the FlyingSawAxis used in servo clock. Declared in: LFlyingSaw_Types/LFS_typeFlyingSawAxisServoValues
LFS_type FlyingSawInfo	The structure includes data about the actual leading value, the actual position of the leading value as well as its length from the perspective of the flying saw. Declared in: LFlyingSaw_Types/LFS_typeFlyingSawInfo
LFS_type LCMRetProfileAccel	Return structure of FC LCMRetProfileAccel Declared in: LFlyingSaw_Types/LFS_typeLCMRetProfileAccel
LFS_type LCMRetProfileDist	Return structure of FC LCMRetProfileDist Declared in: LFlyingSaw_Types/LFS_typeLCMRetProfileDist
LFS_type LCMRetProfileJerk	Return structure of FC LCMRetProfileJerk Declared in: LFlyingSaw_Types/LFS_typeLCMRetProfileJerk
LFS_type LCMRetProfileTime	Return structure of des FC LCMRetProfileTime Declared in: LFlyingSaw_Types/LFS_typeLCMRetProfileTime
LFS_type LeadingValueCommand	This structure contains the command interface to the axis FB for the LeadingValue (Axis or ExternalEncoder!) Declared in: LFlyingSaw_Types/LFS_typeLeadingValueCommand
LFS_typeLeadingValue MeasuringInputCommand	This structure contains the command interface to the MeasuringInput Declared in: LFlyingSaw_Types/LFS_typeLeadingValueMeasuringInput Command
LFS_typeLeadingValue MeasuringInputOutput	This structure contains all the required feedback signals of the MeasuringInput. Declared in: LFlyingSaw_Types/LFS_typeLeadingValueMeasuringInput Output
LFS_type LeadingValueOutput	This structure contains all the required feedback signals of the LeadingValue. (Axis or ExternalEncoder!) Declared in: LFlyingSaw_Types/LFS_typeLeadingValueOutput

Name of the structure	Content
LFS_type LeadingValueTOs	This structure contains all possible TOs which can be assigned to a LeadingValue. Declared in: LFlyingSaw_Types/LFS_typeLeadingValueTOs
LFS_typeMeasuringValue	This structure contains the internal data area for determining the cut position. Declared in: LFlyingSaw_Types/LFS_typeMeasuringValue
LFS_typeShiftPosCalc	This structure contains all relevant data for supervision of dynamic start position adaption. Declared in: LflyingSaw_Types/LFS_typeShiftPosCalc
LFS_typeUsersInterface	The structure contains the interface for users to enter geometrical and motion data of the mechanical system of the shears – and to specify operating variants. Declared in: LFlyingSaw_Types/LFS_typeUsersInterface

7.3.1 LFS_typeAutoCutting (UDT)

Description

This structure contains all the required parameter for simulating a cut with defined time if no real machine is available: LFlyingSaw_Types/BasicTypes/ LFS_typeAutoCutting

Parameter description

Identifier	Data type	Default value	Description
autoCuttingActive	Bool	FALSE	Test auto cutting active
autoCuttingTime	Int	100	Test auto cutting time

7.3.2 LFS_typeAxisTOs (UDT)

Description

This structure contains all the required TOs as DB_ANY. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeAxisTOs

Parameter description

Identifier	Data type	Default value	Description
toFlyingSawAxis	DB_ANY	---	Interconnection of FlyingSaw axis TO
leadingValue	Array[1..LFS_MAX_NUMBER_OF_LEADING_VALUES] of LFS_typeLeadingValueTOs	---	This structure contains all necessary TOs of a leading value. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueTOs

7.3.3 LFS_typeCutPositionBuffer (UDT)

Description

This structure contains the buffer in which the cut positions with the associated position deviations are saved. Declared in: LFlyingSawTypes/BasicTypes/ LFS_typeCutPositionBuffer

Parameter description

Identifier	Data type	Default value	Description
cutPositionsMeasured	Array[0..LFS_CPB_MAX-1] of LReal	---	[mm] Buffer for the measured cut positions
cutPositionsMeasuredNumberModulo	Array[0..LFS_CPB_MAX-1] of DInt	---	Buffer for the numberof modulo of measured cut positions
cutPositionsRead	Array[0..LFS_CPB_MAX-1] of Bool	---	Buffer of flag "cut position read"
cutPositionsEntered	Array[0..LFS_CPB_MAX-1] of Bool	---	Buffer of flag "cut position entered"
OnTheSpotCutPositionsEntered	Array[0..LFS_CPB_MAX-1] of Bool	---	Buffer of on the spot cut flags

7.3.4 LFS_typeCutPositionBufferManagement (UDT)

Description

This structure contains the internal data area for entering precise cut position for the print mark cutting. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeCutPositionBufferManagement

Parameter description

Identifier	Data type	Default value	Description
cutPositionBuffer	LFS_typeCutPositionBuffer	---	This structure contains the buffer in which the cut positions with the associated position deviations are saved. Declared in: LFlyingSawTypes/BasicTypes/ LFS_typeCutPositionBuffer
bufferIn	Int	0	Pointer to the next input position of buffer
bufferOut	Int	0	Pointer to next output position of buffer
cutCorrectionWait	Int	0	Number of cuts without cut correction
bufferReadTrigger	Bool	FALSE	Start trigger to read the next buffer entry

7.3.5 LFS_typeFlyingSaw (UDT)

Description

This structure contains the complete global data of the SIMATIC FlyingSaw application. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSaw

Parameter description

Identifier	Data type	Default value	Description
axisTOs	LFS_typeAxisTOs	---	This structure contains all the required TOs as DB_ANY. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeAxisTOs
usersInterface	LFS_typeUsersInterface	---	This structure contains the interface for the user to enter physical conditions, dynamics and FlyingSaw behaviour. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeUsersInterface
cutPositionBufferManagement	LFS_typeCutPositionBufferManagement	---	This structure contains the internal data area for entering precise cut position for the print mark cutting. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeCutPositionBufferManagement
flyingSawInfo	LFS_typeFlyingSawInfo	---	This structure contains the internal data area to display actual l values, actual cut position as well as binary signals for the FlyingSaw position. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawInfo
measuringValue	LFS_typeMeasuringValue	---	This structure contains the internal measuring data area for the print mark cutting. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeMeasuringValue
cutLength	LReal	800.0	[mm] format length
execute	Bool	FALSE	Activates the mode of operation switchover with the operating mode specified in “Mode”.
mode	DInt	0	Using mode, the mode is preselected, which is activated with the next positive edge at the execute input
stopCutting	Bool	FALSE	Cutting has been finished
knifeOut	Bool	FALSE	Tool is out of material
gapLength	LReal	10.0	Length of the gap
gap	Bool	FALSE	Move a gap afterwads a cut

Identifier	Data type	Default value	Description
doubleCutLength	LReal	100.0	Length of double cut
doubleCut	Bool	FALSE	Activate double cut
onTheSpotCut	Bool	FALSE	Activate on the spot cut
skipNextCut	Bool	FALSE	Skip next cut
constantVelocityAtCut	Bool	FALSE	Assume constant leading value velocity during synchronous phase
numberLeadingValueSelected	Int	0	Number of selected leading value
done	Bool	FALSE	TRUE: Selected mode is activated
busy	Bool	FALSE	TRUE: Operating mode switchover is active
error	Bool	FALSE	TRUE: Displays an error within the FBs or at the flying saw axes. Details see errorID.
cut	Bool	FALSE	TRUE: FlyingSaw is in synchronousPhase
flyingSawInStartPos	Bool	FALSE	TRUE: FlyingSaw stands in its startposition
endSyncPosReached	Bool	FALSE	TRUE: FlyingSaw has reached the end of synchornous range
handoverPosReached	Bool	FALSE	TRUE: FlyingSaw has reached the handover position
onTheSpotCutPossible	Bool	FALSE	TRUE: On the spot cut is possible
onTheSpotCutDone	Bool	FALSE	TRUE: On the spot cut has been done
skipNextCutPossible	Bool	FALSE	TRUE: Skip next cut is possible
syncNotPossible	Bool	FALSE	TRUE: Synchronization is not possible, because upper limit for starting synchronization was overrun in automatic state "AR_GEARIN_FSA_ABSOLUTE" or "AR_GEARIN_FSA_RELATIVE" before starting synchronization
forSyncToLate	Bool	FALSE	TRUE: Synchronization is not possible, because upper limit for starting synchronization was overrun in automatic state "AR_WAIT_FOR_FLYING_SAW_START" or "AR_POS_STARTPOS_NEXT_START" before starting synchronization
numberLeadingValueActive	Int	0	Number of active leading value
errorID	DWord	16#0000 0000	Error code. The ErrorIDs are described in this document.

Identifier	Data type	Default value	Description
state	DInt	0	Active mode LFS_OM_ERROR (0): ERROR mode LFS_OM_DISABLE (1): DISABLE mode LFS_OM_START_POSITION (2): STARTPOSITION mode LFS_OM_AUTOMATIC (3): AUTOMATIC mode LFS_OM_MANUAL (4): MANUAL mode LFS_OM_NOTHING_SELECTED (8): No mode change LFS_OM_CHANGING (9): Mode change active
flyingSawAxisActive	Bool	FALSE	TRUE: FlyingSaw axis is enabled
startPositionAutoAdaptAct	Bool	FALSE	Automatic adapting of startposition is active
userCommandFlyingSawAxis	LFS_typeFlyingSawAxisCommand	---	This structure contains the command interface to the axis FB, reduced to the requirements of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisCommand
userConfigFlyingSawAxis	LAxisCtrl_typeAxisConfig	---	
internalCommandFlyingSawAxis	LFS_typeFlyingSawAxisCommand	---	This structure contains the command interface to the axis FB, reduced to the requirements of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisCommand
internalConfigFlyingSawAxis	LAxisCtrl_typeAxisConfig	---	
outputFlyingSawAxis	LFS_typeFlyingSawAxisOutput	---	This structure contains all the required feedback signals of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisOutput
internalCommandLeadingValueMeasuringInput	LFS_typeLeadingValueMeasuringInputCommand	---	This structure contains the command interface to the axis FB, reduced to the requirements of the measuring input. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueMeasuringInputCommand

Identifier	Data type	Default value	Description
outputLeadingValueMeasuringInput	LFS_typeLeadingValueMeasuringInputOutput	---	This structure contains all the required feedback signals of the measuring input at the leading value. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueMeasuringInputOutput
commandLeadingValue	LFS_typeLeadingValueCommand	---	This structure contains the command interface to the axis FB, reduced to the requirements of the leading value. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueCommand
configLeadingValue	LAxisCtrl_typeAxisConfig	---	
outputLeadingValue	LFS_typeLeadingValueOutput	---	This structure contains all the required feedback signals of the FlyingSaw axis, Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisOutput

7.3.6 LFS_typeFlyingSawAxisCommand (UDT)

Description

This structure contains the command interface to the axis FB, reduced to the requirements of the FlyingSaw axis. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisCommand

Parameter description

Identifier	Data type	Default value	Description
enable	Bool	FALSE	TRUE: Enable functionality of FB
enableAxis	Bool	FALSE	TRUE: Set axis enable; FALSE: Remove axis enable
resetAxis	Bool	FALSE	Rising edge: Acknowledgment of technology alarms or restart of the axis (depending on configuration)
jogForward	Bool	FALSE	Rising edge: Move an axis in jog mode (forward); Falling edge: Stop jogging
jogBackward	Bool	FALSE	Rising edge: Move an axis in jog mode (backward); Falling edge: Stop jogging
moveVelocity	Bool	FALSE	Rising edge: Move an axis at constant velocity/speed
stop	Bool	FALSE	Rising edge: Brake an axis until it comes to a standstill. Note: MC_Halt is triggered internally
fastStop	Bool	FALSE	Rising edge: Brake an axis until it comes to a standstill (with fastStop dynamics). Note: MC_Halt is triggered internally

Identifier	Data type	Default value	Description
torqueLimiting	Bool	FALSE	TRUE: Enable force/torque limiting
homing	Bool	FALSE	Rising edge: Home axis
posRelative	Bool	FALSE	Rising edge: Move an axis relative to its position when execution of the job began
posAbsolute	Bool	FALSE	Rising edge: Move an axis to an absolute position
gearInRelative	Bool	FALSE	Rising edge: Start a gearing operation (relative)
gearInAbsolute	Bool	FALSE	Rising edge: Start a gearing operation (absolute)
offset	Bool	FALSE	Rising edge: Start an offset operation
simulation	Bool	FALSE	TRUE: Axis is in gearIn simulation mode
phasing	Bool	FALSE	Rising edge: Start a phasing operation
posSuperimposed	Bool	FALSE	Rising edge: Start a superimposed operation

7.3.7 LFS_typeFlyingSawAxisOutput (UDT)

Description

This structure contains all the required feedback signals of the FlyingSaw axis.
Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisOutput

Parameter description

Identifier	Data type	Default value	Description
valid	Bool	FALSE	TRUE: Axis-FB displays valid
busy	Bool	FALSE	TRUE: Axis-FB active
error	Bool	FALSE	TRUE: Axis-FB in error state. Status and Diagnostic provide further information. The meaning can be looked up in the LAxisCtrl manual.
status	Word	16#0000	Status word of the axis FB. The meaning can be looked up in the LAxisCtrl operating instructions.
commandBusy	Bool	FALSE	TRUE: Selected command active. There is an extra variable for the superimposed movement.
commandDone	Bool	FALSE	TRUE: Selected command completed. There is an extra variable for the superimposed movement.
commandAborted	Bool	FALSE	TRUE: Selected command canceled. There is an extra variable for the superimposed movement.
superimposedBusy	Bool	FALSE	TRUE: Superimposed command active
superimposedDone	Bool	FALSE	TRUE: Superimposed command completed
superimposedAborted	Bool	FALSE	TRUE: Superimposed command canceled
homingBusy	Bool	FALSE	TRUE: Homing active
homingDone	Bool	FALSE	TRUE: Homing completed
homingAborted	Bool	FALSE	TRUE: Homing canceled
jogSelected	Bool	FALSE	TRUE: Jog operation selected
moveVelocitySelected	Bool	FALSE	TRUE: Velocity-controlled operation selected

Identifier	Data type	Default value	Description
posAbsoluteSelected	Bool	FALSE	TRUE: Absolute positioning selected
posRelativeSelected	Bool	FALSE	TRUE: Relative positioning selected
posSuperimposedSelected	Bool	FALSE	TRUE: MC_MoveSuperimposed selected
homingSelected	Bool	FALSE	TRUE: Homing selected
stopSelected	Bool	FALSE	TRUE: Stop selected
fastStopSelected	Bool	FALSE	TRUE: Stop (fast) selected
torqueLimitingSelected	Bool	FALSE	TRUE: Torque limiting is selected
gearInRelativeSelected	Bool	FALSE	TRUE: Relative synchronous operation selected
gearInAbsoluteSelected	Bool	FALSE	TRUE: Absolute synchronous operation selected
phasingSelected	Bool	FALSE	TRUE: MC_Phasing is selected
offsetSelected	Bool	FALSE	TRUE: MC_Offset is selected
diagnostics	LAxisCtrl_typeDiagnostics	---	
toFollowingAxis	Bool	FALSE	TRUE: Axis is an following axis
toDriveCommunicationOk	Bool	FALSE	TRUE: drive exists and is switched on
toEnabled	Bool	FALSE	TRUE: TO is switched on
toError	Bool	FALSE	TRUE: TO is in the error state. More detailed information can be found in the TO structure.
toErrorReaction	DInt	0	Error response
toDriveInOperation	Bool	FALSE	TRUE: drive is ready and is generating a torque
toRestartActive	Bool	FALSE	TRUE: Restart at the TO active
toStandstill	Bool	FALSE	TRUE: drive is at a standstill
toHomed	Bool	FALSE	TRUE: axis-TO is homed
toHomingActive	Bool	FALSE	TRUE: Homing is active at the TO
toJogActive	Bool	FALSE	TRUE: Jog operation is active at the TO
toSynchronizing	Bool	FALSE	TRUE: Synchronizing is active at the TO
toSynchronous	Bool	FALSE	TRUE: The TO is synchronized
toActualPosition	LReal	0.0	[mm] Actual position of the TO
toActualVelocity	LReal	0.0	[mm/s] Actual velocity of the TO
toActualAcceleration	LReal	0.0	[mm/s²] Actual acceleration of the TO
toModuloEnabled	Bool	FALSE	TRUE: Modulo length is activated at the TO
toModuloLength	LReal	0.0	[mm] Modulo length
toNotPositionControled	Bool	FALSE	TRUE: The TO is not in the position-controlled mode
toMaxVelocity	LReal	0.0	[mm/s] Maximum velocity of the TO
toMaxAcceleration	LReal	0.0	[mm/s²] Maximum acceleration of the TO
toMaxDeceleration	LReal	0.0	[mm/s²] Maximum deceleration of the TO
toLeadScrew	LReal	0.0	[mm] Spindle pitch (leadscrew)

Identifier	Data type	Default value	Description
toGearFactor	LReal	0.0	[-] Gear ratio
toVirtualAxisMode	UDInt	0	0 not a virtual axis 1 virtual axis
usersCommandActive	Bool	FALSE	TRUE: TO can be operated by the user. FALSE: TO is operated via the standard application.
toStatusSensorState	DInt	0	Status of the encoder value
toSetVelocity	LReal	0.0	Set velocity from TO
toSyncMotionLVVelocity	LReal	0.0	[TO_Unit] Effective leading value velocity of the synchronization (TO.StatusSynchronizedMotion.EffectiveLeadingValue.Velocity). This velocity is the leading veloicty for the synchronization of the flying saw axis
toSyncMotionLVPosition	LReal	0.0	[TO_Unit] Effective leading value position of the synchronization (TO.StatusSynchronizedMotion.EffectiveLeadingValue.Position). This position is the leading position for the synchronization of the flyingSaw axis

7.3.8 LFS_typeFlyingSawAxisServoValues (UDT)

Description

This structure contains values to display the TO data from FlyingSaw axis read in the servo clock cycle. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisServoValues

Parameter description

Identifier	Data type	Default value	Description
flyingSawAxisPosition	LReal	0.0	[mm] set position of FlyingSaw axis
flyingSawAxisActualPosition	LReal	0.0	[mm] actual position of FlyingSaw axis
flyingSawAxisStatusword	DWord	16#00000000	statusword of FlyingSaw axis
toSyncMotionLVPosition	LReal	0.0	[mm] Effective leading value position of the synchronization (TO.StatusSynchronizedMotion.EffectiveLeadingValue.Position). This position is the leading position for the synchronization of the flyingSaw axis
toSyncMotionLVVelocity	LReal	0.0	[mm/s] Effective leading value velocity of the synchronization (TO.StatusSynchronizedMotion.EffectiveLeadingValue.Velocity). This velocity is the leading veloicty for the synchronization of the flying saw axis

7.3.9 LFS_typeFlyingSawInfo (UDT)

Description

This structure contains the internal data area to display actual l values, actual cut position as well as binary signals for the FlyingSaw position. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawInfo

Parameter description

Identifier	Data type	Default value	Description
toLeadingValueActive	DB_ANY	---	DB number of active leading value
toLeadingValueMeasuringInputActive	DB_ANY	---	Measuring input active. This variable is needed for implezite value transformation.
toLeadingValueSyncAxisLeadingValueActive	DB_ANY	---	If the leading axis of the FlyingSaw axis is also a synchronous axis, it is possible that this leading axis has another leading axis. TheDB-number of this master axis is entered in this variable.
numberOfLeadingValuesEntered	Int	0	Number of possible leading values
changeLeadingValueActive	Bool	FALSE	Change of leading value active
axisAsLeadingValue	Bool	FALSE	TRUE: Leading value is a real or virtual axis (no external encoder) FALSE: Leadingvalue is an external encoder
externalEncoderAsLeadingValue	Bool	FALSE	TRUE: Leading value is an external encoder FALSE: No external encoder specified as leading value
leadingValueActive	Bool	FALSE	TRUE: Leading value axis is enabled
leadingValueStandstill	Bool	FALSE	TRUE: Leading value axis is in standstill
leadingValueDirectionPositive	Bool	FALSE	TRUE: Leading value moves in positive direction
leadingValueDirectionNegative	Bool	FALSE	TRUE: Leading value moves in negative direction
materialPosActualStart	LReal	0.0	[mm] Material position when FlyingSaw starts movement
materialPosActualStartNumberModulo	DInt	0	[-] Number of modulo overflows of materialPosActualStart
materialPosActual	LReal	0.0	[mm] Actual material position
materialPosActualNumberModulo	DInt	0	[-] Number of modulo overflows of actual material position
onTheSpotCutSelected	Bool	FALSE	On the spot cut is selected
maZeroPos	LReal	0.0	[mm] Material position when printmark reach FlyingSaw axis zero point
maZeroPosNumberModulo	DInt	0	[-] Number of modulo overflows of maZeroPos
maSyncPos	LReal	0.0	[mm] Actual sychron position on material
maSyncPosNumberModulo	DInt	0	[-] Number of modulo overflows of maSyncPos

Identifier	Data type	Default value	Description
maOffset	LReal	0.0	[mm] Actual offset between the reference systems material-axis and the axis of the flying saw
maPosForTechnologie	LReal	0.0	[mm] Actual position of the material axis in the reference system of the flying saw axis
cutLengthActivated	LReal	0.0	[mm] Activated format length
leadingValueDeltaSyncPos	LReal	0.0	[mm] Leading value difference between two synchronous positions
deltaTwoCutsCutLength	LReal	0.0	[mm] Measured/Calculated length between two cuts
interruptProductionActivated	Bool	FALSE	Interrupt production is activated
continueProductionActivated	Bool	FALSE	Continue production is activated
productionInterrupted	Bool	FALSE	Production is interrupted
productionContinued	Bool	FALSE	Production is continued
lowerLimit	LReal	0.0	[mm] Minimum material position to start synchronization
lowerLimitNumberModulo	DInt	0	[-] Number of modulo overflows of lowerLimit
deltaNumberModuloLowerLimit	DInt	0	[-] Modulo difference between LowerLimit and the actual material position
upperLimitToLate	LReal	0.0	[mm] Maximum material position to start synchronization
upperLimitToLateNumberModulo	DInt	0	[-] Number of modulo overflows of upperLimitToLate
upperLimitNotPossible	LReal	0.0	[mm] Material position to cancel synchronization
upperLimitNotPossibleNumberModulo	DInt	0	[-] Number of modulo overflows of upperLimitNotPossible
deltaNumberModuloToLate	DInt	0	[-] Modulo difference between UpperLimitToLate and the actual material position
deltaNumberModuloNotPossible	DInt	0	[-] Modulo difference between UpperLimitNotPossible and the actual material position
cutPositionGenerationMode	DInt	2	Generation of cutposition 1: printmark detection, 2: cut to format length
cutPositionMeasureMode	DInt	1	Determination of buffer entries 1: real measuring input, 2: simulate printmark
shiftPosition	LReal	0.0	[mm] Shift position of startposition when adapting it
estimatedCutWay	LReal	180.0	[mm] Estimated material and FlyingSaw way during cutting without gap and double cut
syncPositionMaster	LReal	0.0	[mm] Actual SyncPosition of the leading value axis
syncPositionMasterNumberModulo	DInt	0	[-] Number of modulo overflows of the actual SyncPosition of the leading value axis

Identifier	Data type	Default value	Description
syncPositionSlave	LReal	0.0	[mm] Actual SyncPosition of the FlyingSaw axis
actualCuttingTime	LReal	0.0	[ms] actual cutting time
materialVelocityActual	LReal	0.0	[mm/s] actual material velocity
mAStartSyncDistance	LReal	0.0	[mm] material distance to be moved before starting next synchronization
fsaPositionMaximum	LReal	0.0	Maximum FlyingSaw position at stillstand after cut, before driving back to startposition
materialPassed	LReal	0.0	[mm] Material distance from the start of the cut until the shears come to a standstill
maPositionAtFSAStandstill	LReal	0.0	[mm] material position when FlyingSaw is at stillstand after cut and before returning back to startposition
syncLengthActual	LReal	0.0	[mm] Actual synchronizing length
measuredAtStandstill	Bool	FALSE	TRUE: Sensor was activated when the shears were at a standstill
accelerationActive	LReal	0.0	[mm/s²] active acceleration
jerkActive	LReal	0.0	[mm/s³] active jerk
runningBackTimeActual	LReal	0.0	[s] actual running back time

7.3.10 LFS_typeLCMRetProfileAccel (UDT)

Description

This structure contains all internal values to calculate an acceleration based profile. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLCMRetProfileAccel

Parameter description

Identifier	Data type	Default value	Description
accel	LReal	0.0	
functionResult	DInt	0	

7.3.11 LFS_typeLCMRetProfileDist (UDT)

Description

This structure contains all internal values to calculate the distance how long a profile needs to be done. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLCMRetProfileDist

Parameter description

Identifier	Data type	Default value	Description
dist	LReal	0.0	
functionResult	DInt	0	

7.3.12 LFS_typeLCMRetProfileJerk (UDT)

Description

This structure contains all internal values to calculate an jerk based profile. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLCMRetProfileJerk

Parameter description

Identifier	Data type	Default value	Description
jerk	LReal	0.0	
functionResult	DInt	0	

7.3.13 LFS_typeLCMRetProfileTime (UDT)

Description

This structure contains all internal values to calculate the time how long a profile needs to be done. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLCMRetProfileTime

Parameter description

Identifier	Data type	Default value	Description
tGes	LReal	0.0	
functionResult	DInt	0	

7.3.14 LFS_typeLeadingValueCommand (UDT)

Description

This structure contains the command interface to the axis FB, reduced to the requirements of the leading value. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueCommand

Parameter description

Identifier	Data type	Default value	Description
enable	Bool	FALSE	TRUE: Enable functionality of FB
resetAxis	Bool	FALSE	Rising edge: Acknowledgment of technology alarms or restart of the axis (depending on configuration)
enableAxis	Bool	FALSE	TRUE: Set axis enable; FALSE: Remove axis enable
jogForward	Bool	FALSE	Rising edge: Move an axis in jog mode (forward); Falling edge: Stop jogging
jogBackward	Bool	FALSE	Rising edge: Move an axis in jog mode (backward); Falling edge: Stop jogging
moveVelocity	Bool	FALSE	Rising edge: Move an axis at constant velocity/speed
posAbsolute	Bool	FALSE	Rising edge: Move an axis to an absolute position
posRelative	Bool	FALSE	Rising edge: Move an axis relative to its position when execution of the job began
homing	Bool	FALSE	Rising edge: Home axis
stop	Bool	FALSE	Rising edge: Brake an axis until it comes to a standstill. Note: MC_Halt is triggered internally

Identifier	Data type	Default value	Description
fastStop	Bool	FALSE	Rising edge: Brake an axis until it comes to a standstill (with fastStop dynamics). Note: MC_Halt is triggered internally
torqueLimiting	Bool	FALSE	TRUE: Enable force/torque limiting
gearInRelative	Bool	FALSE	Rising edge: Start a gearing operation (relative)
gearInAbsolute	Bool	FALSE	Rising edge: Start a gearing operation (absolute)
phasing	Bool	FALSE	Rising edge: Start a phasing operation
posSuperimposed	Bool	FALSE	Rising edge: Start a superimposed operation

7.3.15 LFS_typeLeadingValueMeasuringInputCommand (UDT)

Description

This structure contains the command interface to the axis FB, reduced to the requirements of the measuring input. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueMeasuringInputCommand

Parameter description

Identifier	Data type	Default value	Description
miResetExecute	Bool	FALSE	TRUE: Reset (MI) activated
miResetRestart	Bool	FALSE	TRUE: Reset realized with restart
miExecute	Bool	FALSE	TRUE: Measuring input active
miMode	DInt	0	Measurement type 0 Measurement of the next rising edge 1 Measurement of the next falling edge 2 Measurement of the next two edges 3 Measurement at the two edges, starting with the rising edge 4 Measurement at the two edges, starting with the falling edge
miMeasuringRange	Bool	FALSE	TRUE: Only sense the measured values within the measuring range
miStartPosition	LReal	0.0	Initial position of the measuring range
miEndPosition	LReal	0.0	End position of the measuring range

7.3.16 LFS_typeLeadingValueMeasuringInputOutput (UDT)

Description

This structure contains all the required feedback signals of the measuring input at the leading value. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueMeasuringInputOutput

Parameter description

Identifier	Data type	Default value	Description
miResetDone	Bool	FALSE	TRUE: Reset (MI) completed
miResetBusy	Bool	FALSE	TRUE: Reset (MI) active
miResetCommandAborted	Bool	FALSE	TRUE: Reset (MI) command canceled
miResetError	Bool	FALSE	TRUE: Reset (MI) error active

Identifier	Data type	Default value	Description
miResetErrorId	Word	16#0000	Reset (MI) error number
miDone	Bool	FALSE	TRUE: Measurement successfully completed Measured values are valid
miBusy	Bool	FALSE	TRUE: Measurement is being executed
miCommandAborted	Bool	FALSE	TRUE: Measurement task was canceled
miError	Bool	FALSE	TRUE: An error occurred during processing. Information relating to the error cause can be taken from parameter "ErrorID"
miErrorId	Word	16#0000	Error identification of the FB MC_MeasuringInput
miMeasuredValue1	LReal	0.0	First measured value
miMeasuredValue2	LReal	0.0	Second measured value
leadingValueMeasuringInput	Bool	FALSE	TRUE: Measuring input available at the leading value

7.3.17 LFS_typeLeadingValueOutput (UDT)

Description

This structure contains all the required feedback signals of the FlyingSaw axis,
Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeFlyingSawAxisOutput

Parameter description

Identifier	Data type	Default value	Description
valid	Bool	FALSE	TRUE: Axis-FB displays valid
busy	Bool	FALSE	TRUE: Axis-FB active
error	Bool	FALSE	TRUE: Axis-FB in error state. Status and Diagnostic provide further information. The meaning can be looked up in the LAxisCtrl manual.
status	Word	16#0000	Status word of the axis FB. The meaning can be looked up in the LAxisCtrl operating instructions.
commandBusy	Bool	FALSE	TRUE: Selected command active. There is an extra variable for the superimposed movement.
commandDone	Bool	FALSE	TRUE: Selected command completed. There is an extra variable for the superimposed movement.
commandAborted	Bool	FALSE	TRUE: Selected command canceled. There is an extra variable for the superimposed movement.
superimposedBusy	Bool	FALSE	TRUE: Superimposed command active
superimposedDone	Bool	FALSE	TRUE: Superimposed command completed
superimposedAborted	Bool	FALSE	TRUE: Superimposed command canceled
homingBusy	Bool	FALSE	TRUE: Homing active
homingDone	Bool	FALSE	TRUE: Homing completed
homingAborted	Bool	FALSE	TRUE: Homing canceled

Identifier	Data type	Default value	Description
jogSelected	Bool	FALSE	TRUE: Jog operation selected
moveVelocitySelected	Bool	FALSE	TRUE: Velocity-controlled operation selected
posAbsoluteSelected	Bool	FALSE	TRUE: Absolute positioning selected
posRelativeSelected	Bool	FALSE	TRUE: Relative positioning selected
posSuperimposedSelected	Bool	FALSE	TRUE: MC_MoveSuperimposed selected
homingSelected	Bool	FALSE	TRUE: Homing selected
stopSelected	Bool	FALSE	TRUE: Stop selected
fastStopSelected	Bool	FALSE	TRUE: Stop (fast) selected
torqueLimitingSelected	Bool	FALSE	TRUE: Torque limiting is selected
gearInRelativeSelected	Bool	FALSE	TRUE: Relative synchronous operation selected
gearInAbsoluteSelected	Bool	FALSE	TRUE: Absolute synchronous operation selected
phasingSelected	Bool	FALSE	TRUE: MC_Phasing is selected
diagnostics	LAxisCtrl_typeDiagnostics	---	
toFollowingAxis	Bool	FALSE	TRUE: Axis is an following axis
toDriveCommunicationOk	Bool	FALSE	TRUE: drive exists and is switched on
toEnabled	Bool	FALSE	TRUE: TO is switched on
toError	Bool	FALSE	TRUE: TO is in the error state. More detailed information can be found in the TO structure.
toErrorReaction	DInt	0	Error response
toDriveInOperation	Bool	FALSE	TRUE: drive is ready and is generating a torque
toRestartActive	Bool	FALSE	TRUE: Restart at the TO active
toStandstill	Bool	FALSE	TRUE: drive is at a standstill
toHomed	Bool	FALSE	TRUE: axis-TO is homed
toHomingActive	Bool	FALSE	TRUE: Homing is active at the TO
toJogActive	Bool	FALSE	TRUE: Jog operation is active at the TO
toSynchronizing	Bool	FALSE	TRUE: Synchronizing is active at the TO
toSynchronous	Bool	FALSE	TRUE: The TO is synchronized
toActualPosition	LReal	0.0	[mm] Actual position of the TO
toActualPositionNumberModulo	DInt	0	[-] Actual number of modulo cycles of actual position of the leading value
toActualVelocity	LReal	0.0	[mm/s] Actual velocity of the TO
toActualAcceleration	LReal	0.0	[mm/s²] Actual acceleration of the TO
toModuloEnabled	Bool	FALSE	TRUE: Modulo length is activated at the TO
toModuloLength	LReal	0.0	[mm] Modulo length
toNotPositionControled	Bool	FALSE	TRUE: The TO is not in the position-controlled mode

Identifier	Data type	Default value	Description
toDirectionPositive	Bool	FALSE	TRUE: leading value moves in positive direction
toDirectionNegative	Bool	FALSE	TRUE: leading value moves in negative direction
toMaxVelocity	LReal	0.0	[mm/s] Maximum velocity of the TO
toMaxAcceleration	LReal	0.0	[mm/s²] Maximum acceleration of the TO
toMaxDeceleration	LReal	0.0	[mm/s²] Maximum deceleration of the TO
toLeadScrew	LReal	0.0	[mm] Spindle pitch (leadscrew)
toGearFactor	LReal	0.0	[-] Gear ratio
toVirtualAxisMode	UDInt	0	0 not a virtual axis 1 virtual axis
axisAsLeadingValue	Bool	FALSE	TRUE: The leading value is an axis
externalEncoderAsLeadingValue	Bool	FALSE	TRUE: The leading value is an external encoder
toStatusSensorState	DInt	0	Status of the encoder value
toSetVelocity	LReal	0.0	Set velocity from TO
toExtEncInAcceleration	Bool	FALSE	Material on ExternalEncoder is in acceleration
UnitsConversion	Struct	---	Factores for unit conversion of leading value unit to FlyingSaw unit
LengthUnitConversion	LReal	0.0	Length unit conversion from leading value unit to mm
VelocityUnitConversion	LReal	0.0	Velocity unit conversion from leading value unit to mm/s
AccelerationUnitConversion	LReal	0.0	Acceleration unit conversion from leading value unit to mm/s²

7.3.18 LFS_typeLeadingValueTOs (UDT)

Description

This structure contains all necessary TOs of a leading value. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeLeadingValueTOs

Parameter description

Identifier	Data type	Default value	Description
toLeadingValue	DB_ANY	---	TO leading Value
toMeasuringInput	DB_ANY	---	TO measuring input according to leading value
toSyncAxisLeadingValue	DB_ANY	---	TO leading value for leading value, if leading value is an axis

7.3.19 LFS_typeMeasuringValue (UDT)

Description

This structure contains the internal measuring data area for the print mark cutting.
Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeMeasuringValue

Parameter description

Identifier	Data type	Default value	Description
startMeasuring	Bool	FALSE	Flag: Start of measured value detection
cutLengthActivated	LReal	0.0	[mm] Actual cut length
measuredValueNew	LReal	0.0	[mm] Actual measured value
measuredValueNewNumberModulo	DInt	0	[-] Number of modulo overflows of the actual measured value
measuredValueOld	LReal	0.0	[mm] Measured value, old
measuredValueOldNumberModulo	DInt	0	[-] Number of modulo overflows of the old measured value
mvDelta	LReal	0.0	[mm] Difference between the new and old measured value
waitForFirstCutPosition	Bool	FALSE	Flag: Wait for first measured value
waitForCyclCutPosition	Bool	FALSE	Flag Wait for cyclic measured value
cutPositionMeasuringActive	Bool	FALSE	Flag: Print mark detection has been activated. Waiting for the first measured value
startPosAtSensorDetected	Bool	FALSE	Flag: Start position (first printmark) measured
applicationInAutomatic	Bool	FALSE	Application in operation mode "LFS_AUTOMATIC"
newCutPositionEntered	Bool	FALSE	Flag: New cut position entered
setPosNextCutPosAtSensor	LReal	0.0	[mm] Interpolated next cut position at the sensor
setPosNextCutPosAtSensorNumberModulo	DInt	0	[-] Number of modulo overflows of the interpolated next cut position at the sensor
setPosToleranceRangeStart	LReal	0.0	[mm] Tolerance bandwidth: Start of the search for the next cutting position (value in mm before expected print mark position)
setPosToleranceRangeEnd	LReal	0.0	[mm] Tolerance bandwidth: End of the search for the next cutting position (value in mm after expected print mark position)
cutPositionErrorCounter	Int	0	Cut position error counter. Counter at which no measured value is present, but the calculated value is used. This value is reset at the next recognized print mark
cutLengthMeasured	LReal	0.0	[mm] Measured cut length
cutPosAtSensor	LReal	0.0	[mm] Measured material position if the cut position is at the measuring point
cutPosAtSensorNumberModulo	DInt	0	[-] Number of modulo overflows of the measured material position if the cut position is at the measuring point

Identifier	Data type	Default value	Description
cutPosAtFlyingSawZeroPos	LReal	0.0	[mm] Interpolated material position if the cut position is at the FlyingSaw zero point
cutPosAtFlyingSawZeroPosNumberModulo	DInt	0	[-] Number of modulo overflows of the interpolated material position if the cut position is at the FlyingSaw zero point
cutPosAtSyncPos	LReal	0.0	[mm] Interpolated material position if the cut position occurs at the synchronous point
cutPosAtSyncPosNumberModulo	DInt	0	[-] Number of modulo overflows of the interpolated material position if the cut position occurs at the synchronous point
blindLengthPosition	LReal	0.0	[mm] Interpolated material position if the blind length is run through
blindLengthPositionNumberModulo	DInt	0	[-] Number of modulo overflows of the interpolated material position if the blind length is run through
blindLengthRunThrough	Bool	FALSE	Flag: blind length is run through
leadingValueModuloActive	Bool	FALSE	Flag: leading value modulo active
leadingValueModuloLength	LReal	0.0	[mm] leading value modulo length

7.3.20 LFS_typeShiftPosCalc (UDT)

Description

This structure contains the internal variables for calculating an adapted startposition if needed. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeShiftPosCalc

Parameter description

Identifier	Data type	Default value	Description
loopCount	DInt	0	[-] Loop counter of shiftposition calculation
shiftPosition	LReal	0.0	[mm] Last shift of start position
maStartSyncDistance	LReal	0.0	[mm] Web distance to next StartSync Position
fsaWayBackToActualStartpos	LReal	0.0	[mm] Way back of FlyingSaw to actual start position
shiftPositionNew	LReal	0.0	[mm] Actual shift of start position
functionResult	DInt	0	[-] Return value of distance calculation

7.3.21 LFS_typeUsersInterface (UDT)

Description

This structure contains the interface for the user to enter physical conditions, dynamics and FlyingSaw behaviour. Declared in: LFlyingSaw_Types/BasicTypes/ LFS_typeUsersInterface

Parameter description

Identifier	Data type	Default value	Description
distanceToSensor	LReal	200.0	[mm] Distance between sensor of printmark detection and FlyingSaw axis zero point
startPos	LReal	0.0	[mm] Start position within the distance-reference system of the flying saw
syncPos	LReal	100.0	[mm] Position within the distance-reference system of the flying saw at which the synchronization operation has been completed (synchronous position)
maxStartPos	LReal	350.0	[mm] Maximum possible start position for dynamic start position determination
handoverPos	LReal	540.0	[mm] Handover position within the distance-reference system of the flying saw
endSyncPos	LReal	550.0	[mm] Maximum synchronous position within the distance-reference system of the flying saw at which the synchronous motion must have been completed (end of the synchronous range)
endPos	LReal	600.0	[mm] End point within the distance-reference system of the flying saw
toStartPosVelocity	LReal	100.0	[mm/s] Velocity when positioning to the start position
gapVelocity	LReal	50.0	[mm/s] Additional velocity when executing greating a gap
cutAcceleration	LReal	100.0	[mm/s²] Acceleration when synchronizing for the cut
cutJerk	LReal	1000000.0	[mm/s³] Jerk when synchronizing for the cut
toStartPosAcceleration	LReal	100.0	[mm/s²] Acceleration when positioning to start position
toStartPosJerk	LReal	1000000.0	[mm/s³] Jerk when positioning to start position
gapAcceleration	LReal	100.0	[mm/s²] Acceleration when executing greating a gap
gapJerk	LReal	1000000.0	[mm/s³] Jerk when executing greating a gap
gearingRatio	LReal	1.0	[-] Virtual gearing ratio between real material and measured values
cpDeltaToleranceRange	LReal	10.0	[mm] Half the tolerance bandwidth for the activation range of the cut position sensing
restart	Bool	FALSE	Flag: Restart (must set by user, is reset by application)

Identifier	Data type	Default value	Description
interruptProduction	Bool	FALSE	Flag: Stopping the Flying Saw in the automatic mode (e.g. for STO)
continueProduction	Bool	FALSE	Flag: Reactivating the Flying Saw in the automatic mode (e.g. after STO)
cutPositionGenerationMode	DInt	2	Method to determine the cut position: LFS_CP_CALCULATED (2): Cut position is calculated and the material position specified by cutting to length LFS_CP_MEASURED (1): Cut position is measured and entered into the CutPositionBuffer
cutPositionMeasureMode	DInt	1	Methods to measure the cut position, only valid if cutPositionGenerationMode = LFS_CP_MEASURED (1): LFS_CPM_DETECTED (1): The cut position is measured using print mark and sensor LFS_CPM_SIMULATED (2): Cut position is calculated from the CutLength that has been selected
typeOfSynchronisation	DInt	1	Synchronizing method to synchronize to the material axis: LFS_BY_TIME (1): Time-related LFS_BY_LEADING_VALUE (2): Distance-related LFS_SYMMETRIC (3): Distance-related, without overshoot of the velocity
wayBackMode	DInt	1	LFS_MOVE_ZERO_POS (1): FlyingSaw travels directly back to startposition after cut LFS_RUN_HANDOVER_POS (2): FlyingSaw travels to handover position after cut, before returning back to startposition
rboActive	Bool	FALSE	TRUE: Running back optimization is activated
rboByAcceleration	Bool	true	TRUE: Running back optimization by adapting the acceleration FALSE: Running back optimization by adapting the jerk
blindlength	LReal	0.0	[mm] Travelling distance without active measuring input when material started
lookForFirstPrintmarkPermanent	Bool	FALSE	TRUE: The measuring input detects each print mark and enters the position in the CutPositionBuffer
lookForFirstPrintmarkAsRequired	Bool	FALSE	Flag: The measuring input detects the next print mark and enters the position in the CutPositionBuffer (If done, the flag will be reset)
maxRunningBackTime	LReal	0.0	[s] Maximum running back time for running back optimization
sampleNumberLWAverageVelocity	UInt	0	[-] Number of measuring values used for calculation the average material velocity. (Used for „Constant Velocity at Cut“)

Identifier	Data type	Default value	Description
doubleCutDynamicFactor	LReal	1.0	[-] Dynamic factor for double cut, = 1.0: length of offest movement = double cut length, > 1.0: higher length of offset movement and therefore smoother offest movement
machineStandstillVelExtEnc	LReal	5.0	[TO Unit of leading value] As soon as the speed of the external encoder TO is below this value, the machine is assumed to be at standstill. External encoders do not have such a setting in the TO, but this is necessary for the application, e.g. for interrupt production.
machineAccelerationExtEnc	LReal	5.0	[TO Unit of leading value] As soon as the acceleration of the external encoder TO is below this value, the machine is assumed to be at constant speed. External encoders do not have such a setting in the TO, but this is necessary for the application.

8 Operating the application

This application serves to simply get to know the functionality of the FB FlyingSaw as it is used in any user application and should be called. This application is prepared for the demonstration case; however, it can be directly adapted to suit the hardware of the user.

Preconditions

The following preconditions must be fulfilled to operate the application example:

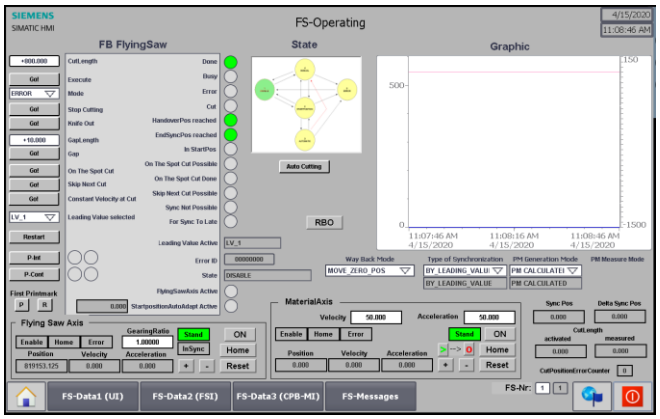
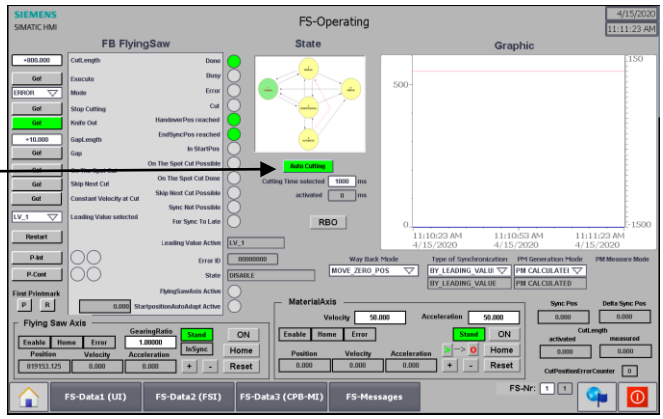
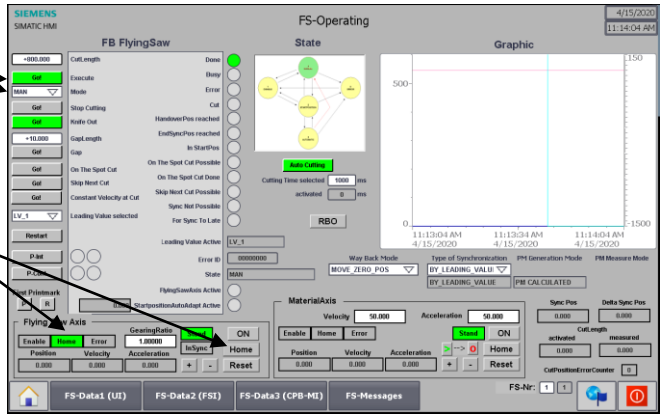
- The SIMATIC TIA project is available online in the SIMATIC S7-15xxT.
- The parameterization for the appropriate application has been loaded into the SINAMICS using Starter.
  CU320-2PN_2xTEL105 for "LeadingValue Axis"
  or
  CU320-2PN_2xTEL105_TEL83 for "LeadingValue EXTERNAL ENCODER"
- all devices relate to Profinet and switched on.
- The SIMATIC S7-15xxT is switched into the "Run" state.
- WinCC Advanced is installed on the PC/PG.

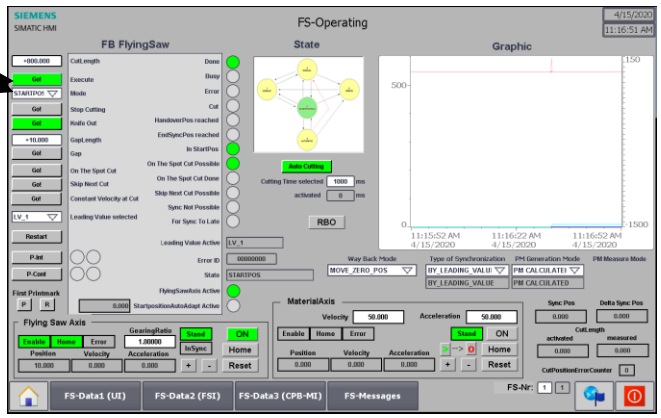
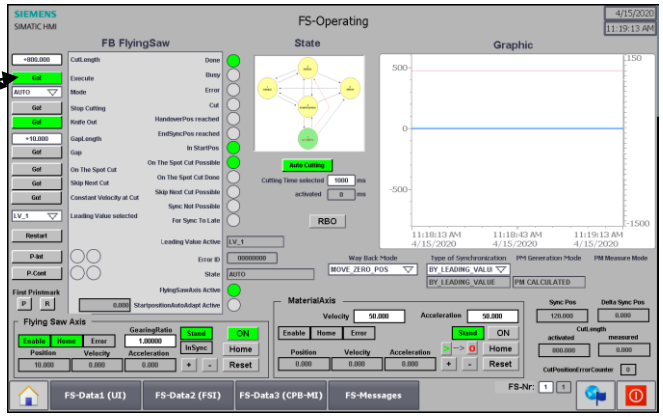
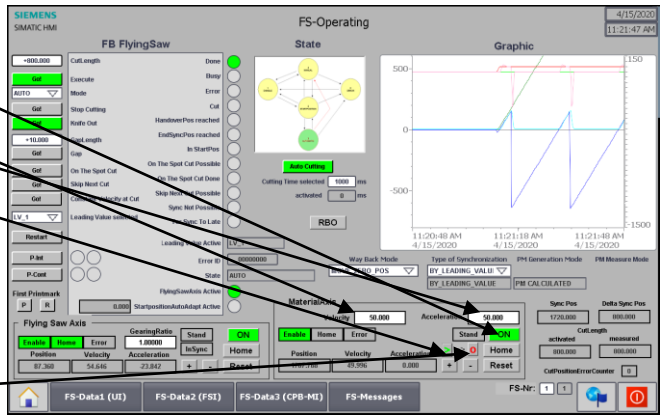
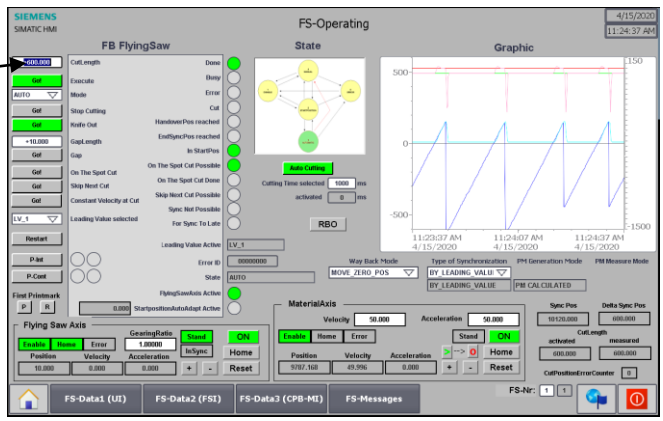
Note WinCC Advanced requires the appropriate authorization. Authorization is required for a minimum of 256 power tags.

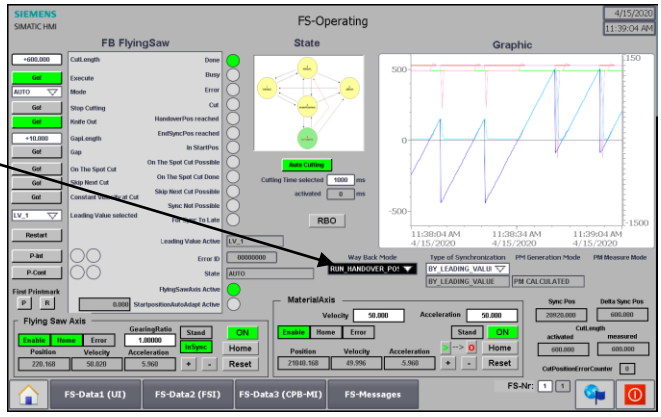
8.1 Operating instructions for the application example

Execute the steps listed in the following table in sequence to demonstrate the application example:

Table 8-1: Operating instructions to present/demonstrate the example project SIMATIC Flying Saw

No.	Action	Remark
1	Start screen after calling the WinCC RT user interface	
2	Activation of "Auto Cutting" With "Auto Cutting", the knife feedback signals are automatically generated, and do not have to be set by the user. This simplifies using the application. This function is activated using the "Auto Cutting" button.	
3	Switch FlyingSaw to manual Select the "Manual" mode Activate the "Execute" button (edge 0→1!) Home the FlyingSaw axis using the "Home" button (The axis is homed if "Homed" is lit!)	

4	Move the FlyingSaw to the start position Select the "Start position" mode Activate the "Execute" button (edge 0→1!)	
5	Switch the FlyingSaw into the automatic mode Select the "Automatic" mode Activate the "Execute" button (edge 0→1!)	
6	Activating material motion Switch-on the material axis Select velocity value Select acceleration Start motion (stop motion)	
7	Change the cut length in operation The change is made by entering a new cut length	

8	Changing the transfer position The change is performed by selecting the "Way back mode"	
9	We hope you are successful in checking out the application	

8.2 Operating/overview screen form FS operating

8.2.1 FS Operating

Fig. 8-1 FS operating

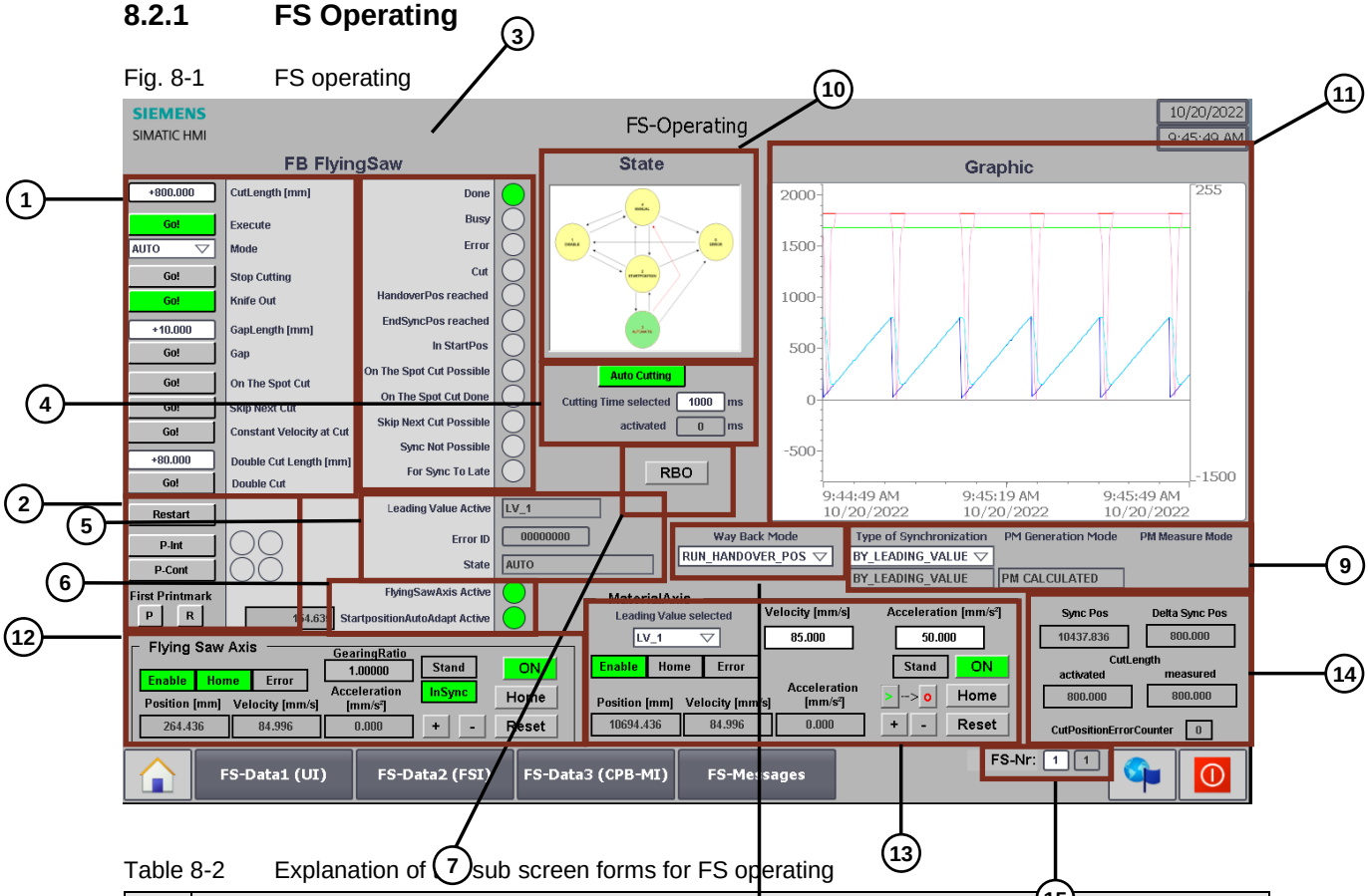


Table 8-2 Explanation of the sub screen forms for FS operating

No.	Sub Screen Form
1.	**Standard operation LFS_FlyingSaw** The following are specified and displayed here • Cut length • Operating mode selected • Signals to control the saw • Gap • Double cut • Immediate cut • Skip next cut • Cut with constant velocity (not exact synchronous to material velocity!)
2.	**Extended operation LFS_FlyingSaw** The following are specified and displayed here • Restart • Interrupt/continue production • First print mark
3.	**Standard display LFS_FlyingSaw** • Outputs from LFS_FlyingSaw
4.	**"Auto Cutting"**

No.	Sub Screen Form
	The "Auto Cutting" function generates the control signals for the saw for test operation (without material and saw!)
5.	**“Leading Value Active”, "ErrorID" and "State"** The following are displayed here • Active leading value • Error messages of LFS_FlyingSaw in ErrorID • The actual operating state of LFS_FlyingSaw in State
6.	**Extended display LFS_FlyingSaw** The following are displayed here • Whether the FlyingSaw axis is active • Whether the start position is automatically shifted
7.	**Operation and display of running back optimization (RBO)** The following are specified and displayed here • Whether RBO is activated • Whether optimization is carried out based on the jerk, or the acceleration
8.	**Using the "Way back mode"** The "Way back mode" is specified here. Either after cut "Travel to handover position" or "Travel to start position".
9.	**Operation and display of the synchronization mode and cut position determination**
10.	**"State" display area**
11.	**"Graphic" display area** **Legend:** material velocity [mm/s] Y axis, right flying saw velocity [mm/s] Y axis, right flying saw position [mm] Y axis, left relative material position [mm] Y axis, left
12.	**Operating/display area of the FlyingSaw axis**
13.	**Operating/display area of the leading value**
14.	**Display area of the calculated cut accuracy**
15.	**Operating and monitoring of the actual visualized instance** The actual visualized instance can be switched here.

8.2.2 Parameterizing screen form FS-Data1 (UI)

Fig. 8-2 FS-Data1 (UI)

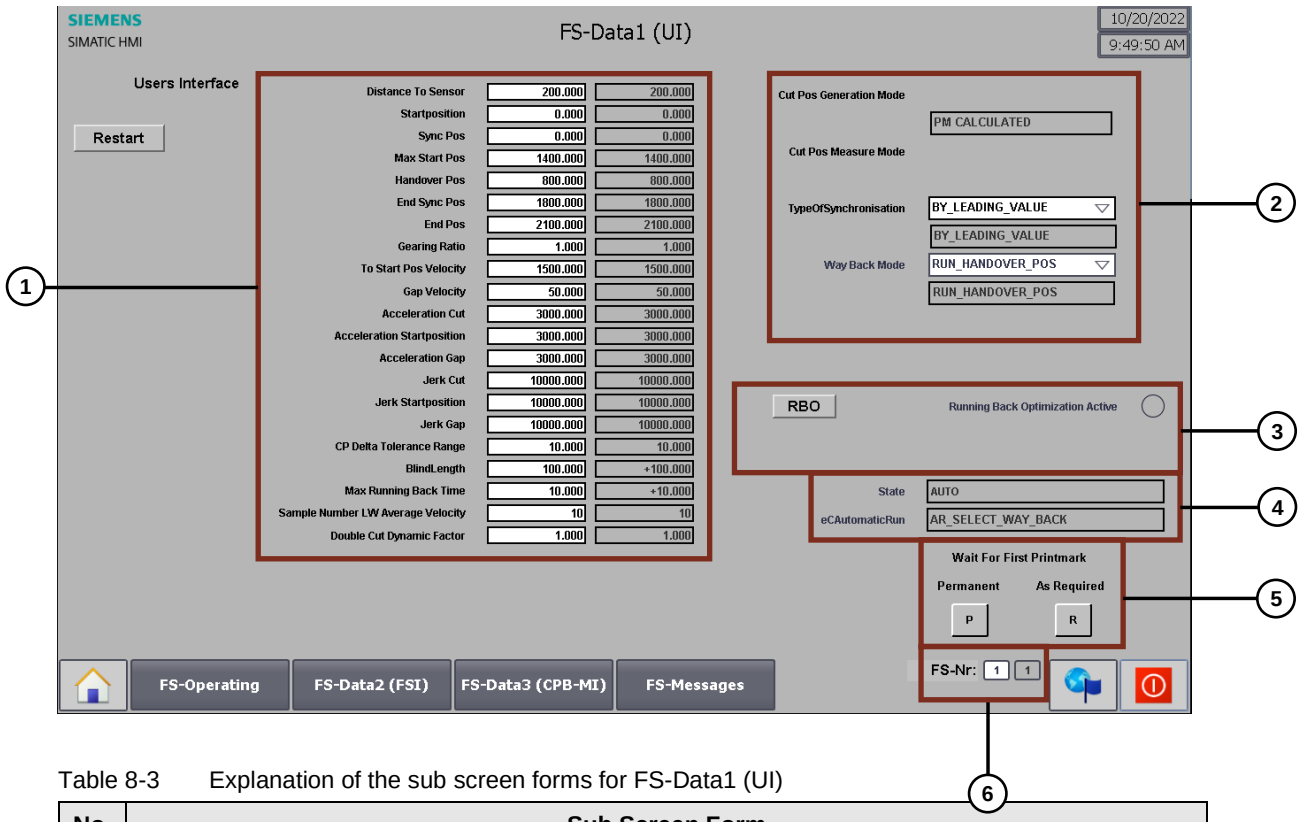


Table 8-3 Explanation of the sub screen forms for FS-Data1 (UI)

No.	Sub Screen Form
1.	**Input of numerical usersInterface**
2.	**Input area for text-based user parameters**
3.	**Operation and display of running back optimization (RBO)**
4.	**Display of the operating state and state of the automatic run state machine**
5.	**Control of the print mark detection**
6.	**Operating and monitoring of the actual visualized instance** The actual visualized instance can be switched here.

8.2.3 Diagnostics screen form FSdata2 (FSI)

Fig. 8-3: FS-Data2 (FSI)

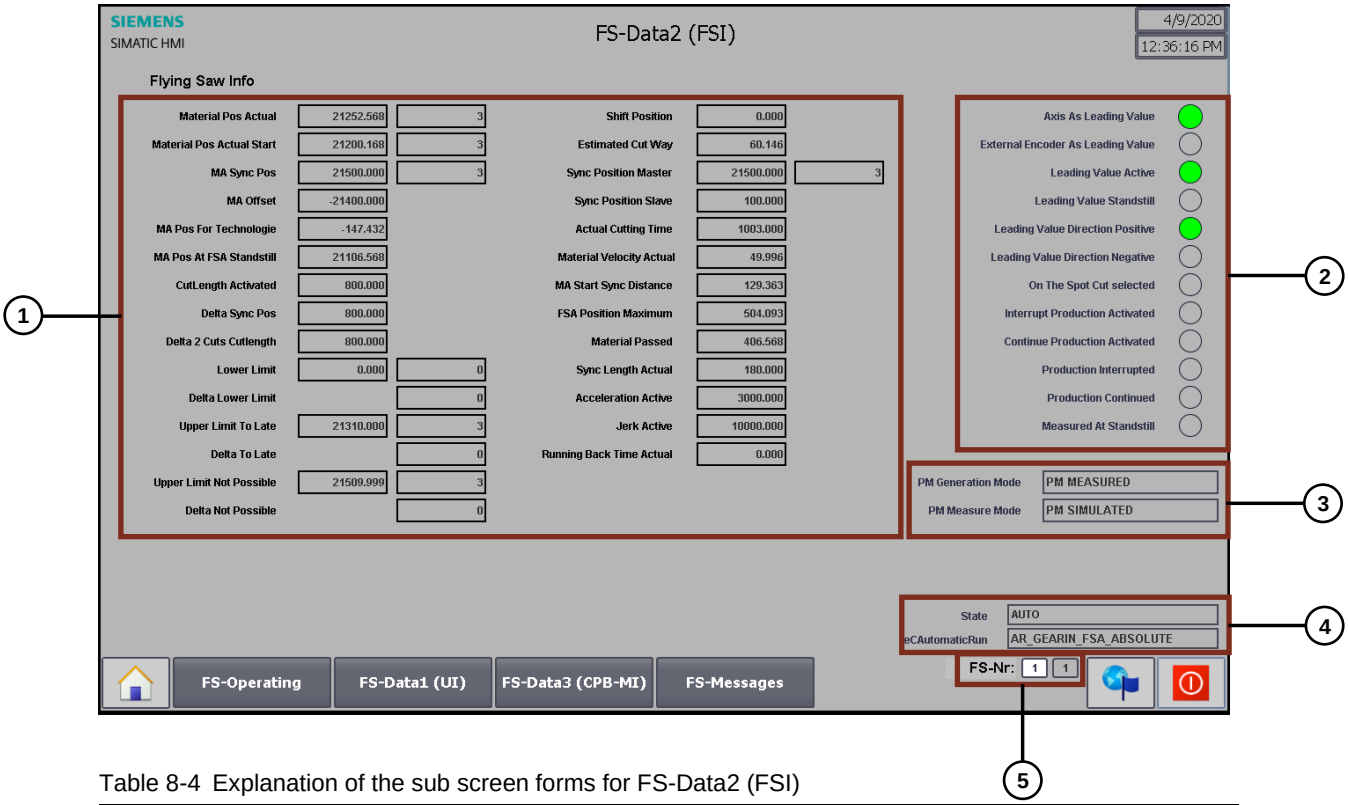


Table 8-4 Explanation of the sub screen forms for FS-Data2 (FSI)

No.	Sub Screen Form
1.	**Display of the numerical data "Flying Saw Info"**
2.	**Display of the binary data "Flying Saw Info"**
3.	**Display of the text-based data "Flying Saw Info"**
4.	**Display of the operating state and state of the automatic run state machine**
5.	**Operating and monitoring of the actual visualized instance** The actual visualized instance can be switched here.

8.2.4 Diagnostics screen form FS-Data3 (CPB-MI)

Fig. 8-4 FS-Data3 (CPB-MI)

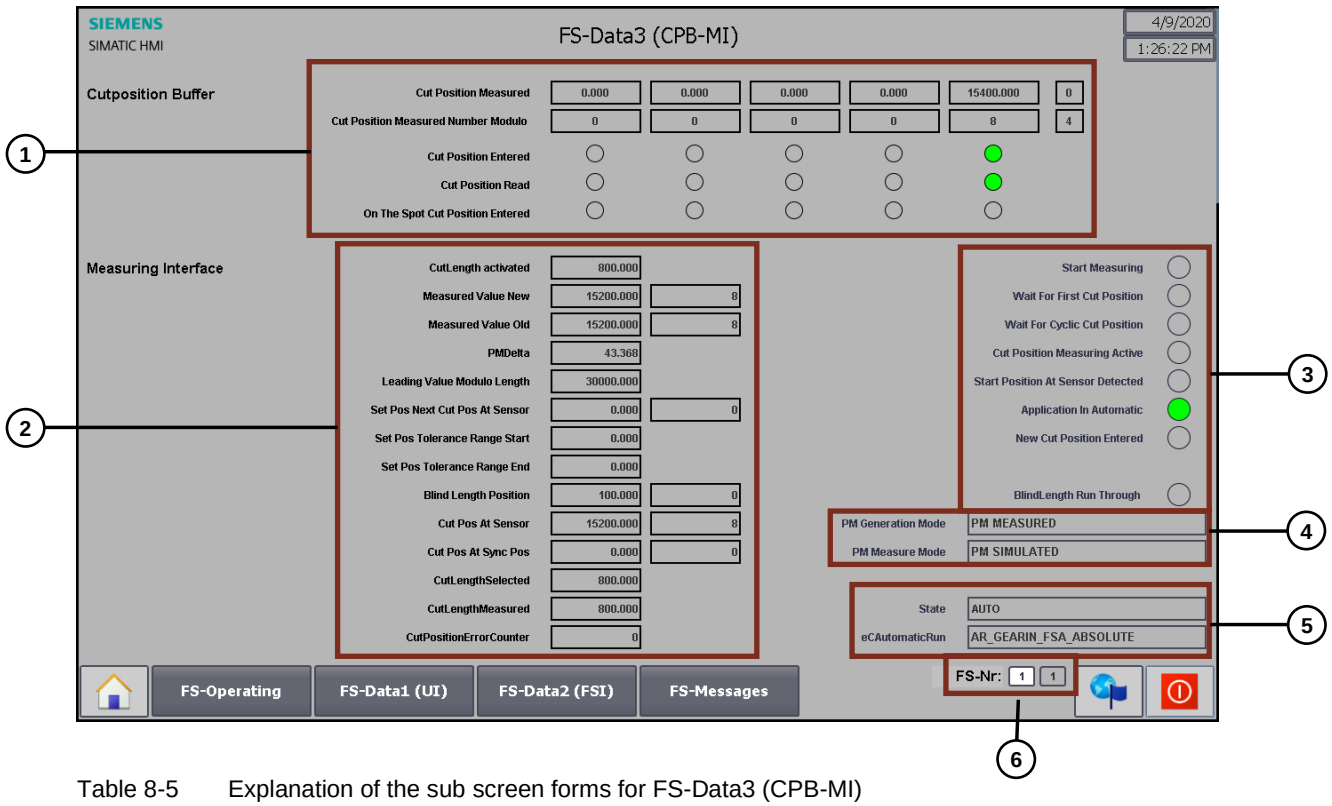
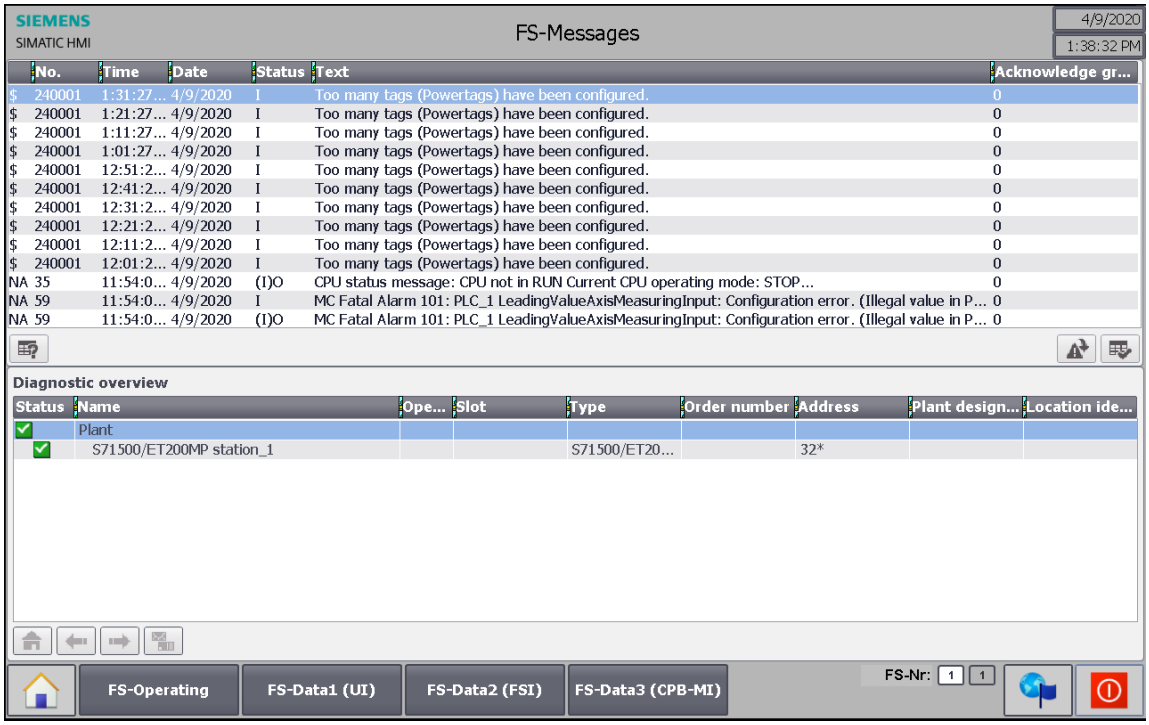


Table 8-5 Explanation of the sub screen forms for FS-Data3 (CPB-MI)

No.	Sub Screen Form
1.	**Display of the CutPositionBuffers**
2.	**Display of the numerical data of the MeasuringInterface**
3.	**Display of the binary signals of the MeasuringInterface**
4.	**Display of the cut position determination**
5.	**Display of the operating state and state of the automatic run state machine**
6.	**Operating and monitoring of the actual visualized instance** The actual visualized instance can be switched here.

8.2.5 Diagnostic screen form FS messages

Fig. 8-5 System error display



9 Appendix

9.1 Service and Support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

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Please send queries to Technical Support via Web form:

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Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for iOS and Android:

support.industry.siemens.com/cs/ww/en/sc/2067

9.2 Industry Mall

The Siemens Industry Mall is the platform on which the entire siemens Industry product portfolio is accessible. From the selection of products to the order and the delivery tracking, the Industry Mall enables the complete purchasing processing – directly and independently of time and location:
mall.industry.siemens.com

9.3 Contact persons

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mailto: printing.converting.team.automation@siemens.com

9.4 References

Table 9-1 References

	Subject
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Download page of the article https://support.industry.siemens.com/cs/ww/en/view/109744840
\3\	Download page of the axis FB library LAxisCtrl https://support.industry.siemens.com/cs/de/de/view/109749348

9.5 Documentation History

Table 9-2 History

Version	Date	Change
V 1.0	04/2017	Creation
V 1.1	08/2019	The following increments are added: • Structure “axisTOs” (necessary for switching between several axis and external encoders) • Dynamic start position

Version	Date	Change
		• Skip next cut • Constant velocity at cut
V 1.1.1	04/2020	The following increment is added: • Several instances of flying saw are possible
V 1.2.0	03/2021	The following increments are added (see ChangeLog): • Velocity filters set in the technology object are taken into account • Bug Fixes were made
V 1.3.0	04/2021	The added increments can be seen in the ChangeLog
V 1.3.1	06/2021	The added increments can be seen in the ChangeLog
V 1.4.0	10/2022	- The added increments can be seen in the ChangeLog - Manual was revised and shortened