Flying shear & Follow shear

POU Library Manual

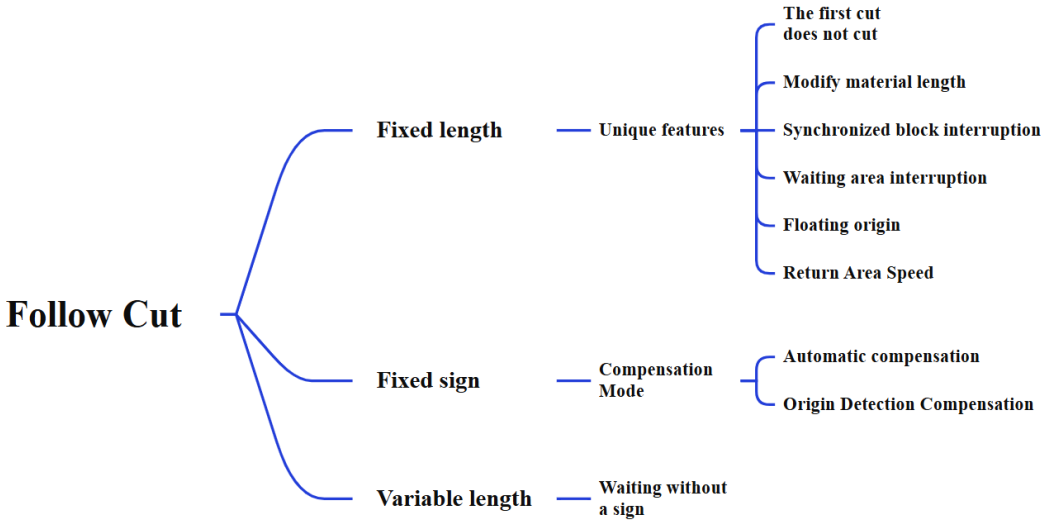
I. Change Record

version number	Change Date	Changeer	Change Content
V1.0.24	2024/1/17	Peng Zhenkai	Fix point: 1. Producing waste when converting floating origin short pieces into long pieces 2. Modified tool count restrictions: The tool count is limited to 1 for the eccentric wheel and crank-rocker modes; no upper limit applies in other cases. The synchronization angle for the eccentric wheel mode should be <180°/tool, and the linear synchronization angle should be <360°/tool.
V1.0.25	2024/2/23	Peng Zhenkai	Fix point: 1. Different scenarios occur with flying shears, linear synchronous fixed-length cutting, and shear phase settings. 2. The spacing between color scale cut points is limited by parameter settings; CAM imposes no restrictions.
V1.0.26	2024/4/29	Peng Zhenkai	Fix point: When switching between custom cam tables such as an eccentric wheel, a speed step occurs at the current cycle EOP. Change the effective target of Probe 2 on page 23 (from axis to spindle)
V1.0.28	2024/7/4	Lu Li	Fix point: 1. Update the documentation regarding color scale cutoff spacing: In the calibration and variable-length modes for follow-cutting and fly-cutting, the "color scale cutoff spacing" parameter must be set to ">material length" or "=0".

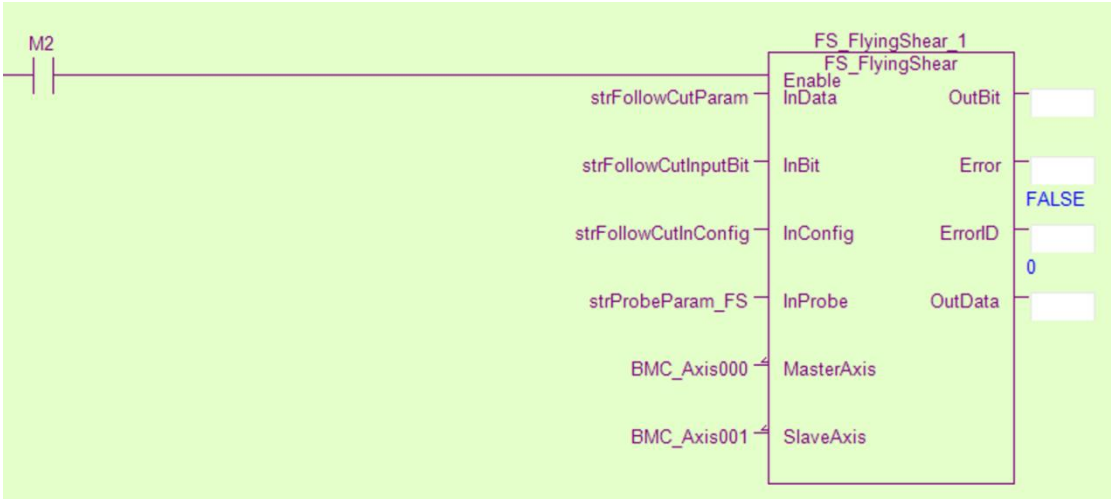
V1.0.28	2024/7/19	Lu Li	Fix point: 1. Add a color scale definition diagram applicable to both fixed-scale and variable-length modes.
V1.0.28	2024/7/25	Lu Li	Fix point: 1. Add a schematic diagram illustrating practical application scenarios for manual material length measurement.
V1.0.29	2024/7/27	Lu Li	Fix point: 1. For the "Current Material Length Modification Takes Effect Immediately" feature in the Trailing Trim Fixed Length Mode: Add a supplementary description specifying that the boolean value must be set before modification, and parameters can only be updated in the waiting area with immediate effect.

II. Follow shear POU Usage Instructions

The follow shear features three cutting modes: fixed-length cutting, fixed-scale cutting, and variable-length cutting. Fixed-length cutting, as the name suggests, involves cutting along the axis at integer multiples of the preset material length parameter; this mode requires precise alignment of the initial position. Fixed-scale cutting initiates cutting along the axis upon detection of the incoming material's color code at the detection point, followed by fixed-length cutting at subsequent non-marked positions. The variable-length cutting mode activates cutting along the axis upon detection of the incoming material, while remaining idle until the next color code is detected.



Function Schematic Diagram



Function Block Diagram

1. Input parameter

1.1 General Parameters

Parameter Name	Data type	Explanatory note
PacMode	UINT	Cut Mode
CutLength	LREAL	Material length
AccDist	LREAL	Acceleration distance
SyncDist	LREAL	synchronic distance
DecDist	LREAL	Deceleration distance
RevDist	LREAL	Switching distance
WaitDist	LREAL	Waiting distance
SynRatio	LREAL	Sync Zone Ratio
ScrewRodLength	LREAL	Screw stroke
TimeCut	LREAL	Cut time
ThicknessCutter	LREAL	Cutting blade thickness
MeasuredCutLength	LREAL	Measured material length
RunFlyingShear	BOOL	Enable flag
StopFlyingShear	BOOL	Stop flag bit
StopSlaveMotion	BOOL	Stop the axis
NoReset	BOOL	No reduction required
MasterSource	INT	Main spindle data source
SlaveMotorSpeedLimit	LREAL	Maximum shaft speed

- Cut mode: Used to switch the cutting mode for tracking; 0: fixed-length cut, 1: scale-based cut, 2: variable-length cut;
- Material length: The distance between color scales determined based on the color scale and its spacing at the application site.
- Acceleration distance: The distance moved by the main shaft corresponding to the axis acceleration zone;
- Synchronization distance: The distance the spindle moves when its speed synchronizes with the shaft speed.
- Deceleration distance: the distance moved by the main shaft from the shaft deceleration zone;
- Switching distance: The waiting distance between completing the shaft deceleration phase and returning to the origin, typically serving as a buffer or switching delay for large mechanical equipment, with a standard value of approximately 10 mm.
- Waiting distance: The distance between returning to the origin from the axis and waiting for the next acceleration start, used for mechanical equipment to buffer and adjust the phase of the cutting synchronization after return; typically set at approximately 20 mm.
- Synchronization zone ratio: Modify the speed ratio between the shaft and the main shaft within the synchronization zone; range 0.6–1.4
- Screw stroke: The distance the axis slide table can travel from its origin,

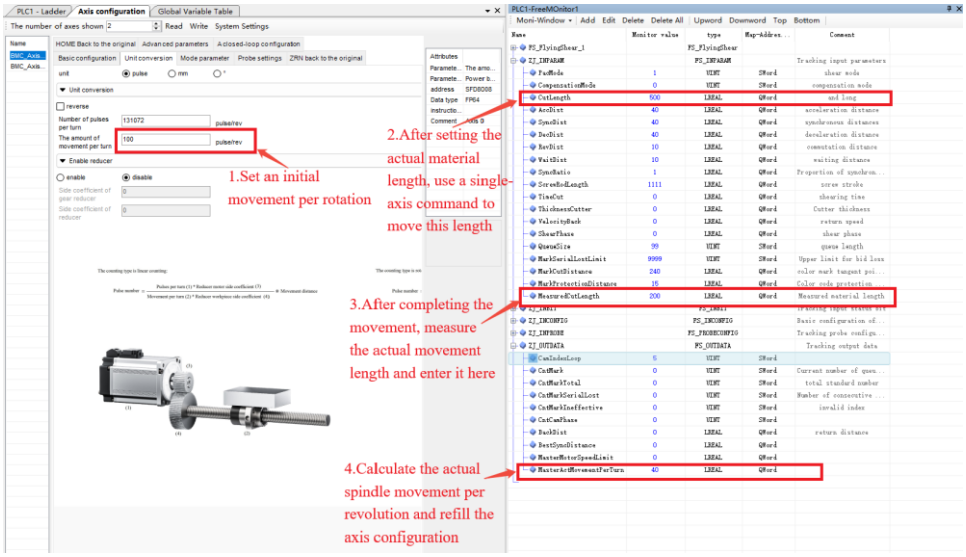
accelerating through the synchronization zone to the deceleration endpoint.

Pay attention to:

□ (Acceleration distance × 0.5 + synchronization distance + deceleration distance × 0.5) × Synchronization zone ratio = Actual axis movement distance <lead screw stroke; if the actual axis movement distance ≥ lead screw stroke, an error will be reported; the "*0.5" factor applies because the POU motion curve planning type uses a 5-stage motion curve.

□ Acceleration distance + synchronization distance + deceleration distance + direction change distance + waiting distance + return distance = material length; the return distance from the shaft and the speed planning for the return section are calculated internally by POU.

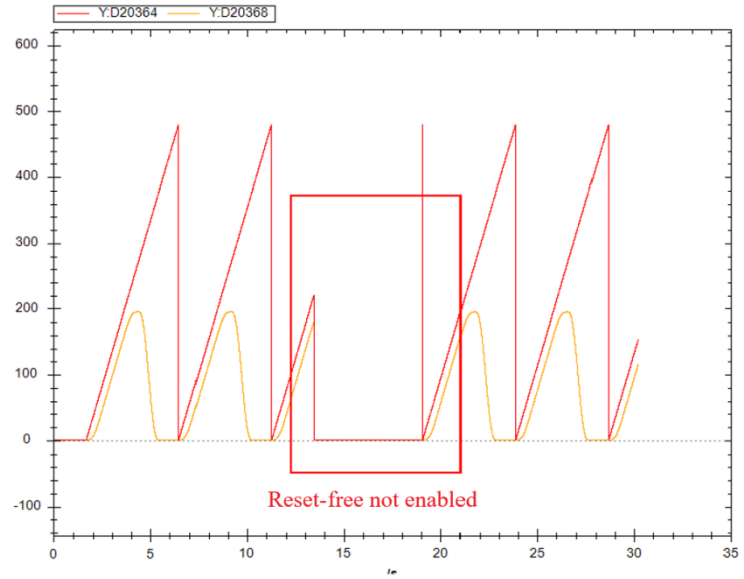
- Cut time: The duration required for the user's cutting device to descend from its starting position to full elevation, measured in ms; hydraulic systems typically require approximately 1000 ms. This parameter is reserved and currently has no functional role.
- Cutting blade thickness: After setting, the actual cutting length equals the specified material length plus the specified blade thickness; if no waste material is present, it is set to 0 mm.
- Measured feed length: Used when the actual per-turn movement of the spindle is unknown. First, set an initial per-turn movement value so that the spindle advances a distance equal to the measured feed length. Using this initial value, the measured actual feed length, and the specified feed length, the spindle's actual per-turn movement can be calculated.
- Note: This is a standard calculation function and does not require enabling POU.

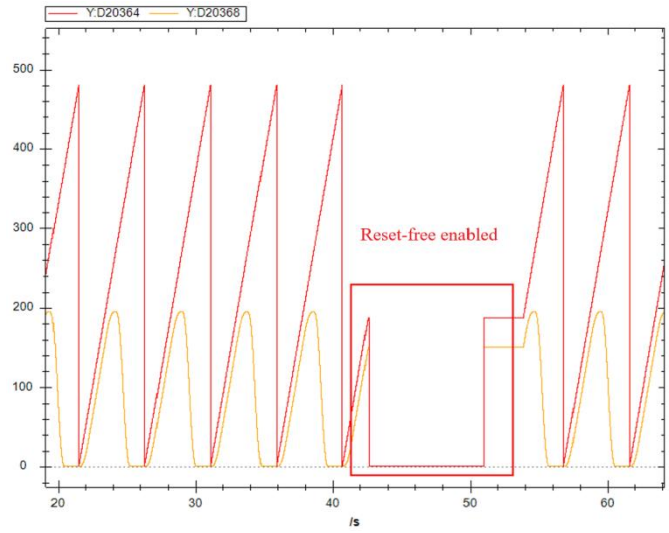


- Enable flag: After completing the parameter settings for the trailing POU, first enable the POU, then set the enable flag to activate the trailing POU; this flag becomes effective upon rising edge detection.
- Stop flag: When the stop flag is set, the master-slave binding relationship is terminated at the end of the cycle, the slave axis stops, and the cam table instance

is released; this flag is activated upon rising edge detection.

- Axis stop: After positioning at the axis stop, immediately solve the master-slave binding relationship, halt the slave axis, and release the cam table instance; the enabling effect of the follow-cut POU command is similarly terminated; this flag becomes active upon rising edge detection.
- Reset-free: Continues the phase movement as before power-off. Before use, select the retention option for the function block in the global variable table to preserve internal data; during operation, activate the pilot channel function block first, then set the reset-free flag, and finally enable the activation flag.





- Spindle data source: The spindle data source bound to the axis motion; 0: Current spindle position specified; 1: Previous spindle position specified; 2: Current spindle position feedback; 3: Previous spindle position feedback. All cases discussed in this manual are written using the default parameter (0), where the current spindle position is specified.
- Maximum spindle speed: measured in RPM; used for internal calculation of the maximum spindle speed within POU. An overspeed alarm is triggered if the actual spindle speed exceeds the maximum value specified in POU output

parameters.

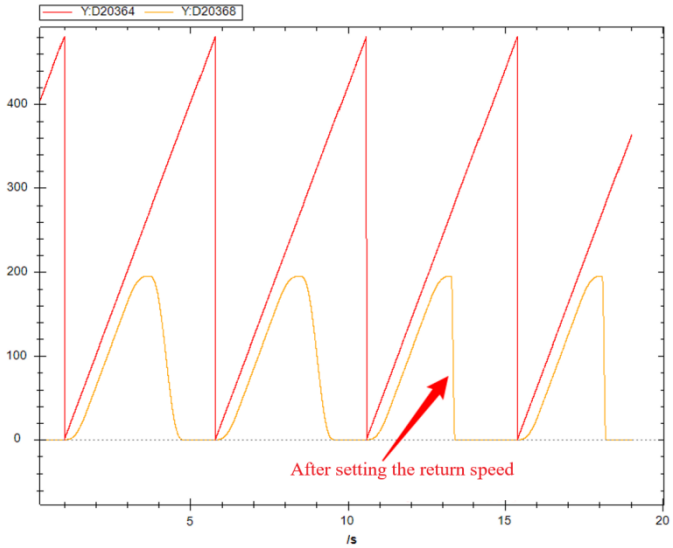
Note: Parameters supporting real-time modification (effective in the next cycle): material length, acceleration distance, synchronization distance, deceleration distance, direction change distance, waiting distance, and synchronization zone ratio.

1.2 Constant-length shear (PacMode=0)

Cut at integer multiples of the set material length according to the color scale. When using fixed-length cutting, ensure consistent intervals between supplied materials' color scales and align the initial positions of the main and auxiliary spindles before operation.

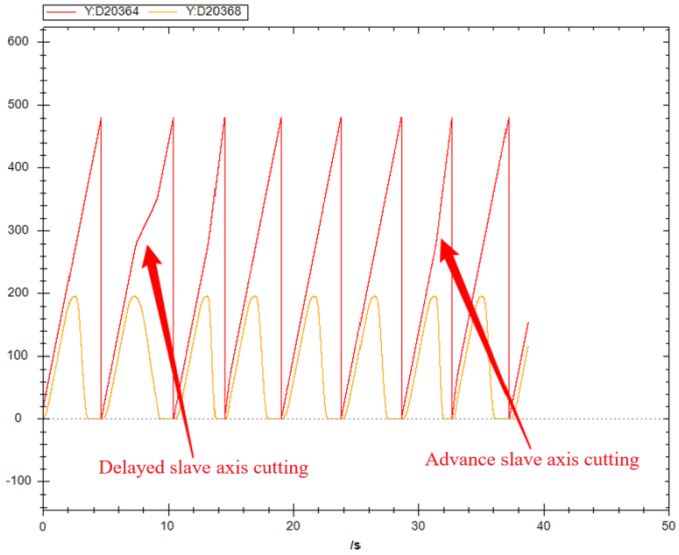
Parameter Name	Data type	Explanatory note
VelocityBack	LREAL	return speed
ShearPhase	LREAL	Cut Phase
ReturnVelocity	BOOL	return speed
FirstCutLengthSkip	BOOL	The first cut does not cut.
CurrentCutLengthModify	BOOL	The material length modification takes effect immediately
FloatOriginalPoint	BOOL	floating zero
InterruptSyncArea	BOOL	Sync period interruption
WaitingAreaInterrupt	BOOL	The wait period ended early

- Return speed: The speed at which the system autonomously plans to return from the spindle to the origin. This setting takes effect only when its value exceeds that of the spindle speed and the return speed flag is activated; the pre-return position applies immediately, otherwise it will be applied in the next cycle.

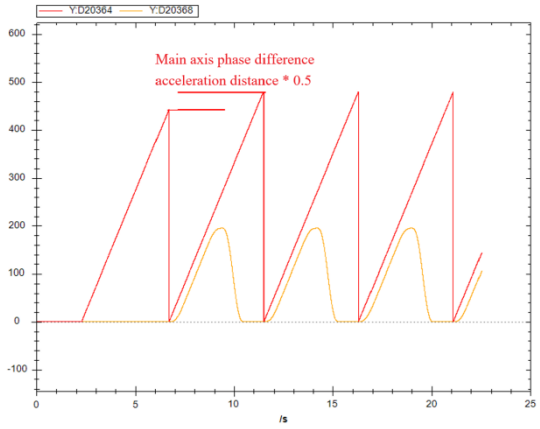


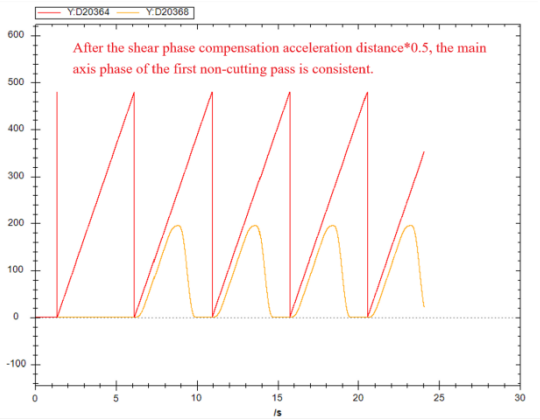
- Shearing Phase: Adjusts the offset of the cutting position relative to the main spindle axis. A positive value delays the cutting action by moving the spindle to its original cutting position plus the shearing phase, effectively delaying the cut; a negative value advances the cutting action by moving the spindle to its original cutting position minus the shearing phase, effectively advancing the cut. The

shearing phase can be set within the range of ±material length.

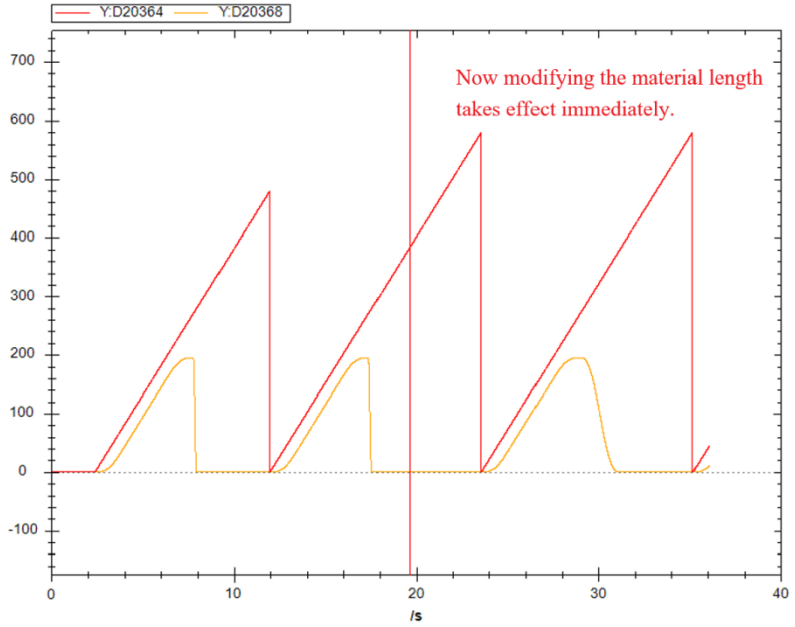


- First-cut skip: After skipping the initial material length, initiate cutting one material length later; this adjustment operates concurrently with the cutting phase, and the delayed cutting distances accumulate mutually. The spindle begins movement after traveling the distance equal to (material length-0.5 × acceleration distance). To avoid an entire material length position, add (0.5 × acceleration distance) to the cutting phase while enabling first-cut skip. During operation, activate the pilot channel function block, set the first-cut skip flag, and finally enable the activation flag.

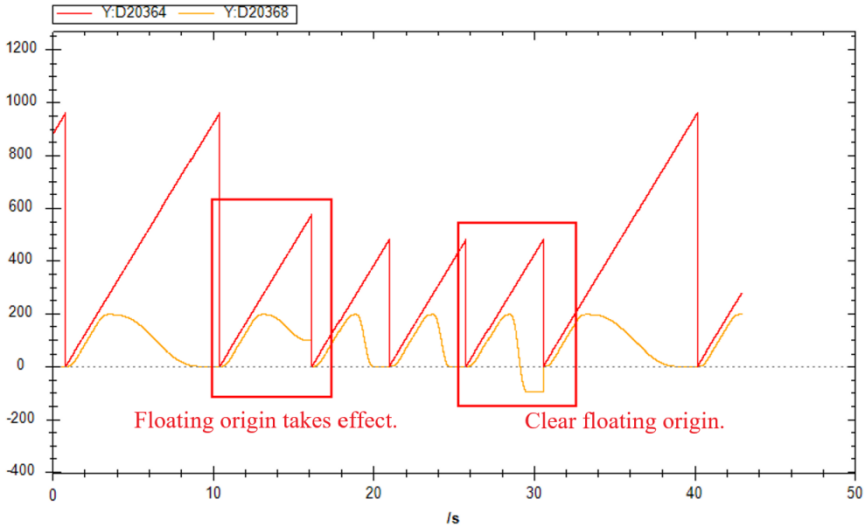




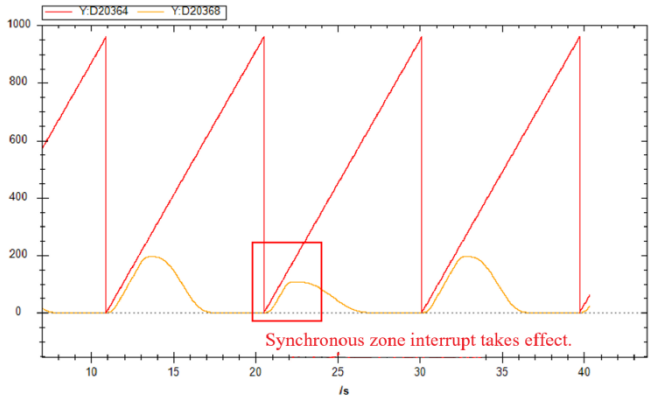
- The current material length modification takes effect immediately: The change applies instantly during the current cycle. The "Pre-modification Flag" determines that parameters can only be updated in the waiting zone, with immediate effect. The modified material length must exceed the phase already executed by the spindle to adjust the waiting zone accordingly—either shortening or extending it.



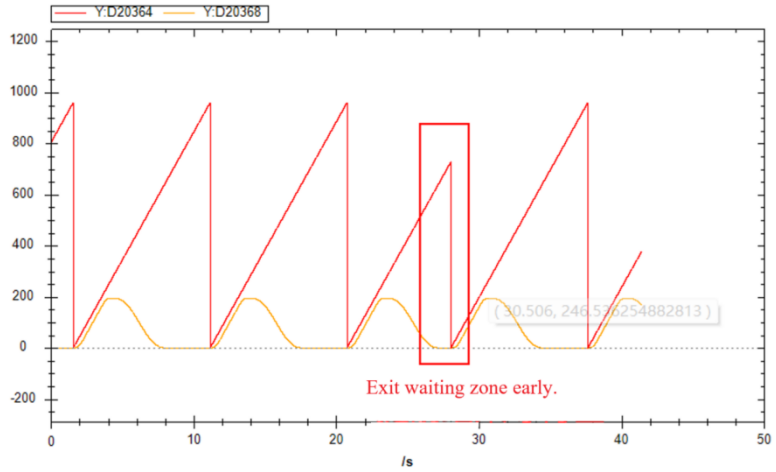
- Floating origin: Used to convert long materials into short materials. This change takes effect immediately in the current cycle and only becomes effective after returning to the area. Set this flag before modifying the material length.



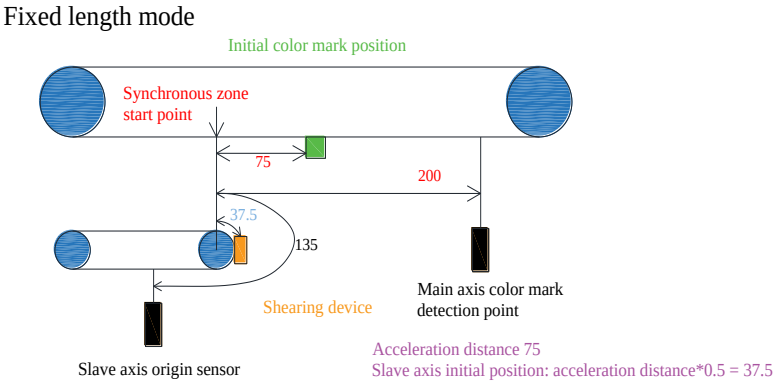
- Sync zone interruption: When the trim is within the sync zone, this flag is set. Upon detecting the rising edge, the sync zone terminates prematurely and transitions into the deceleration zone, effectively ending the sync zone early and correspondingly extending the return period. The cycle length remains unchanged; this feature applies only during the sync zone.



- Early termination of the waiting segment: When the trim is in the waiting zone, set this flag. Upon detecting the rising edge, the waiting segment terminates immediately, and the trim enters the acceleration zone of the next cycle from the axis; this applies only to the waiting zone.



Routine ：



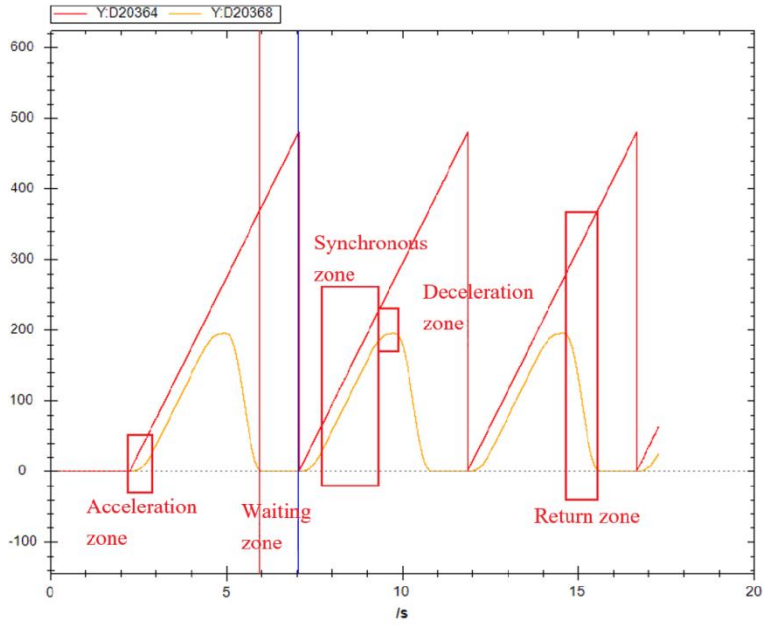
Schematic diagram of color scale and initial position of the cutting device

In the test cam platform, the acceleration zone lies between the initial position (origin) of the shear device and the starting position of the synchronization zone, with a distance of 37.5; since the acceleration distance multiplied by 0.5 represents the distance from the spindle acceleration zone, the actual acceleration distance is 75.

When the synchronization zone ratio is set to 1, the movement distances of the main shaft and the slave shaft within this zone are equal, specified as 120; the deceleration distance is set to 75. The established parameters must satisfy: (acceleration distance × 0.5 + synchronization distance + deceleration distance × 0.5) × synchronization zone ratio = actual movement distance of the slave shaft <lead length; acceleration distance + synchronization distance + deceleration distance + direction-changing distance + waiting distance + return distance = material length; the return distance cannot be directly set and is calculated by subtracting other specified parameters from the material length; the return speed of the slave shaft is determined internally by the control system.

Name	Monitor value	type	Map-Addre...	Comment
FS_FlyingShear_1		FS_F...		
strFollowCutParam		FS_I...		Tracking input parameters
PacMode	0	UINT	SWord	shear mode
CompensationMode	0	UINT	SWord	compensation mode
CutLength	480	LREAL	QWord	and long
AccDist	75	LREAL	QWord	acceleration distance
SyncDist	120	LREAL	QWord	synchronous distances
DecDist	75	LREAL	QWord	deceleration distance
RevDist	0	LREAL	QWord	commutation distance
WaitDist	100	LREAL	QWord	waiting distance
SyncRatio	1	LREAL	QWord	Proportion of synchronous area
ScrewRodLength	200	LREAL	QWord	screw stroke
TimeCut	0	LREAL	QWord	shearing time
ThicknessCutter	0	LREAL	QWord	Cutter thickness
VelocityBack	0	LREAL	QWord	return speed
ShearPhase	0	LREAL	QWord	shear phase
QueueSize	0	UINT	SWord	queue length
MarkSerialLostLimit	0	UINT	SWord	Upper limit for bid loss
MarkCutDistance	0	LREAL	QWord	color mark tangent point spacing
MarkProtectionDistance	0	LREAL	QWord	Color code protection distance
MeasuredCutLength	0	LREAL	QWord	Measured material length
strFollowCutInputBit		FS_I...		Tracking input status bit
RunFlyingShear	TRUE	BOOL	Half-word	enable flag bit
StopSlaveMotion	FALSE	BOOL	Half-word	Stop from axis
NoReset	FALSE	BOOL	Half-word	non-reset
ReturnVelocity	FALSE	BOOL	Half-word	return speed
FirstCutLengthSkip	FALSE	BOOL	Half-word	Don't cut with the first knife
CurrentCutLengthModify	FALSE	BOOL	Half-word	Changes to current material length will t...
FloatOriginalPoint	FALSE	BOOL	Half-word	floating origin
InterruptSyncArea	FALSE	BOOL	Half-word	sync area interruption
WaitingAreaInterrupt	FALSE	BOOL	Half-word	The waiting period ends early
strFollowCutInConfig		FS_I...		Basic configuration of follow-up shearing
MasterSource	0	INT	SWord	spindle data source
SlaveMotorSpeedLimit	0	LREAL	QWord	Maximum speed from shaft

Parameter example



Master-slave motion phase diagram (D20364 represents the master axis phase, D20368 represents the slave axis phase)

1.3 Calibration Shearing (PacMode=1)

Fixed-length cutting: When the color code detection point identifies the first color code, the follow-cut mechanism initiates its operation; after the initial color code is cut, subsequent colors are processed using a fixed-length cutting method, allowing the position of each subsequent color code to vary within ± the color code protection distance from an integer multiple of the material length (i.e., valid codes). If no code exists within this range, cutting proceeds normally along the axis, but the code count is discarded; if the discard threshold (POU) is exceeded, an error is triggered. Due to the permissible positional variation of color codes, phase compensation is applied during the follow-cut movement and performed within the waiting zone.

Parameter Name	Data type	Explanatory note
CompensationMode	LREAL	Compensation Method
ShearPhase	LREAL	Cut Phase
QueueSize	UINT	queue length
MarkSerialLostLimt	UINT	Bid loss ceiling
MarkCutDistance	LREAL	Color scale cutoff interval
MarkProtectionDistance	LREAL	Color scale protection distance
ProbeChannel1	UINT	Probe Channel 1
ProbeSource1	UINT	Probe 1 Data Source
ProbeEdge1	UINT	Probe 1 trigger edge
ProbeSignal1	UINT	Probe 1 trigger signal

- Compensation method:

 Compensation Method 0: By calculating the difference in color code latch positions obtained through color code position latching, determine the spacing between each pair of adjacent targets; compare this value with the material length to compute the compensation amount.

 Compensation Method 1: Since the trailing shear lacks an origin signal detection similar to that of rotary cutting, when the color-scale cutting point exceeds the material length, the entry time into the return zone during each cycle is used as the "origin signal" for the trailing shear, and the spindle's feedback position is recorded.

- Shearing Phase: Adjusts the offset of the cutting position relative to the main spindle axis. A positive value delays the cutting action by moving the spindle to its original cutting position plus the shearing phase, effectively delaying the cut; a negative value advances the cutting action by moving the spindle to its original cutting position minus the shearing phase, effectively advancing the cut. The shearing phase can be set within the range of ±material length.
- Queue length: Valid labels are added to the queue; in calibration mode, a valid label is one whose spacing from the preceding valid label is an integer multiple of the material length ± the color code protection distance; the current valid label is removed from the queue when its position is adjusted in advance via the POU's internal CAMADD instruction or write point; the maximum queue length is 99.
- Maximum lost mark limit: A predefined continuous maximum number of lost marks compared with the output parameter's maximum consecutive lost mark count (CntMarkSerialLost). During calibration trimming, no color code appears within the valid mark range is counted as a lost mark. The calibration trimming follows a fixed-length approach—even without any marks, trimming occurs.

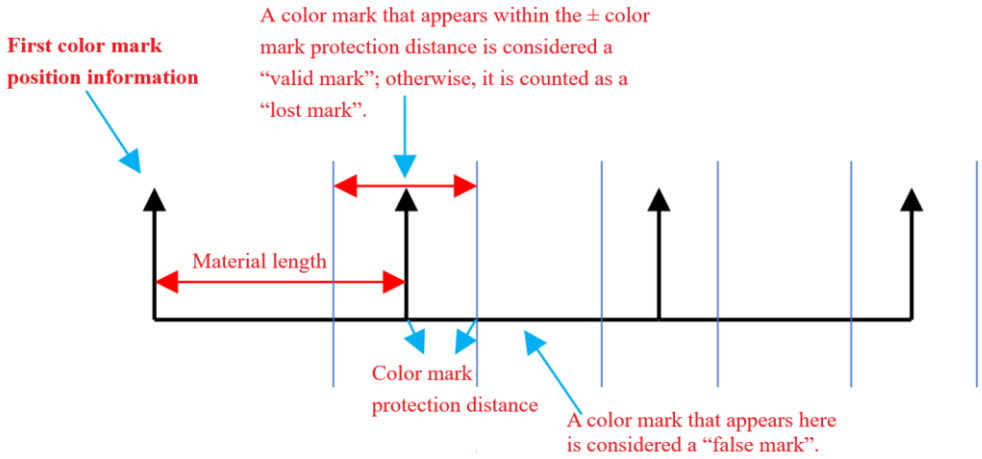
Mislabel: During cyclic operation, if a label appears outside the valid label range, it is considered a mislabel. The categories of color labels include valid labels, lost labels, and mis labels.

- Color scale cut point spacing: The distance between color scale detection points and the cutting points. The cutting point during cutting pursuit corresponds to the start position of the synchronization zone. In actual production, any position within the synchronization zone can serve as the actual cutting point, customizable by the user. In both calibration and variable-length modes, the color scale cut point spacing must be set to ">material length" or "=0" (the cam table is activated immediately upon the first marker entering the queue).
- Color code protection distance: The floating range of the valid mark; marks within ± integer multiples of the material length within this distance are considered valid; typically 10–20 mm; if set too large, axial motion compensation cannot ensure stability.
- Probe 1 channel: 0: Probe 1, 1: Probe 2, 2: Probe 3, 3: Probe 4;
- Probe 1 Data Source: 0: Slave Station; 1: Master Station;
- Probe 1 trigger edge: 0: rising edge, 1: falling edge;
- Probe 1 trigger signal: 0: External; 1: Z-phase; 2–11: External interrupts X2–X13.

Note: The parameter settings for Probe 1 are intended for the color-coded detection points on the spindle, and the calibration mode must be configured. For detailed probe

configurations, refer to the "EtherCAT Motion Control User Manual."

➢ Color Scale Definition Chart

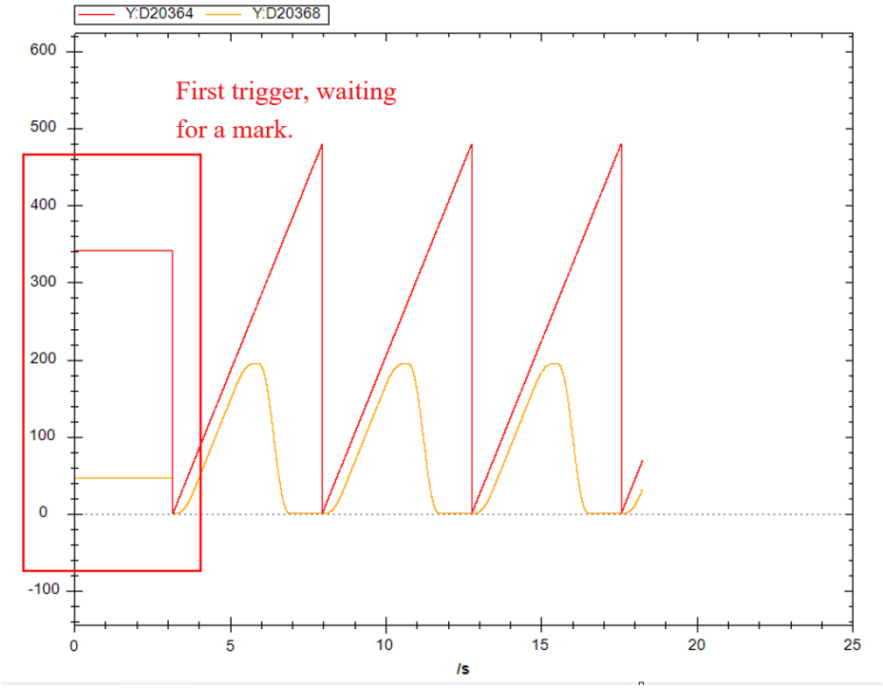


Routine ：

In the test cam platform, the interval between the main shaft color-coded detection points and the starting point of the synchronization zone is 200 units, i.e., the spacing between color-coded cutting points. The input signal for the color-coded detection points is the normally open signal from terminal X5 of the master PLC, corresponding to the relevant parameters of Probe 1.

Name	Monitor value	type	Map-Addres...	Comment
FS_FlyingShear_1		FS_Fly...		
strFollowCutParam		FS_INP...		Tracking input parameters
PacMode	1	UINT	SWord	shear mode
CompensationMode	0	UINT	SWord	compensation mode
CutLength	480	LREAL	QWord	and long
AccDist	75	LREAL	QWord	acceleration distance
SyncDist	120	LREAL	QWord	synchronous distances
DecDist	75	LREAL	QWord	deceleration distance
RevDist	0	LREAL	QWord	commutation distance
WaitDist	100	LREAL	QWord	waiting distance
SyncRatio	1	LREAL	QWord	Proportion of synchron...
ScrewRodLength	200	LREAL	QWord	screw stroke
TimeCut	0	LREAL	QWord	shearing time
ThicknessCutter	0	LREAL	QWord	Cutter thickness
VelocityBack	0	LREAL	QWord	return speed
ShearPhase	0	LREAL	QWord	shear phase
QueueSize	99	UINT	SWord	queue length
MarkSerialLost...	300	UINT	SWord	Upper limit for bid loss
MarkCutDistance	200	LREAL	QWord	color mark tangent poi...
MarkProtection...	20	LREAL	QWord	Color code protection ...
MeasuredCutLength	0	LREAL	QWord	Measured material length
strFollowCutInputBit		FS_INBIT		Tracking input status bit
strFollowCutInConfig		FS_INC...		Basic configuration of...
MasterSource	0	INT	SWord	spindle data source
SlaveMotorSpee...	3000	LREAL	QWord	Maximum speed from shaft
strProbeParam_FS		FS_PRO...		Tracking probe configu...
ProbeChannel1	0	UINT	SWord	Probe 1 Channel
ProbeSource1	1	UINT	SWord	Probe 1 Data Source
ProbeEdge1	0	UINT	SWord	Probe 1 trigger edge
ProbeSignal1	5	UINT	SWord	Probe 1 trigger signal

Standardization Parameter Instance



Master-slave motion phase diagram (D20364 represents the master axis phase, D20368 represents the slave axis phase)

1.4 Variable-length shear (PacMode=2)

Variable-length shear: When the color scale detection point identifies a color mark, the mark moves to the shear position and is cut along the axis. Variable-length shear operates with a wait mode for marks—shearing only when a mark is present; no action occurs if no mark is detected.

Parameter Name	data type	explanatory note
QueueSize	UINT	queue length
MarkSerialLostLimt	UINT	Bid loss ceiling
MarkCutDistance	LREAL	Color scale cutoff interval
ProbeChannel1	UINT	Probe Channel 1
ProbeSource1	UINT	Probe 1 Data Source
ProbeEdge1	UINT	Probe 1 trigger edge
ProbeSignal1	UINT	Probe 1 trigger signal

- Queue length: Marks with a length exceeding the material length are added to the queue; in the variable-length cutting mode, the current mark detected by the color code sensor is positioned more than the set material length away from the previous valid mark; the current valid mark is removed from the queue when its position is adjusted in advance via the POU's internal CAMADD instruction or write-point operation; the maximum queue length is 99.
- Maximum loss limit: A predefined continuous loss limit that compares against the maximum consecutive lost mark count (CntMarkSerialLost) in output parameters. In variable-length truncation, no loss markers exist—only valid and erroneous marks. Currently, a set value is required to run POU.

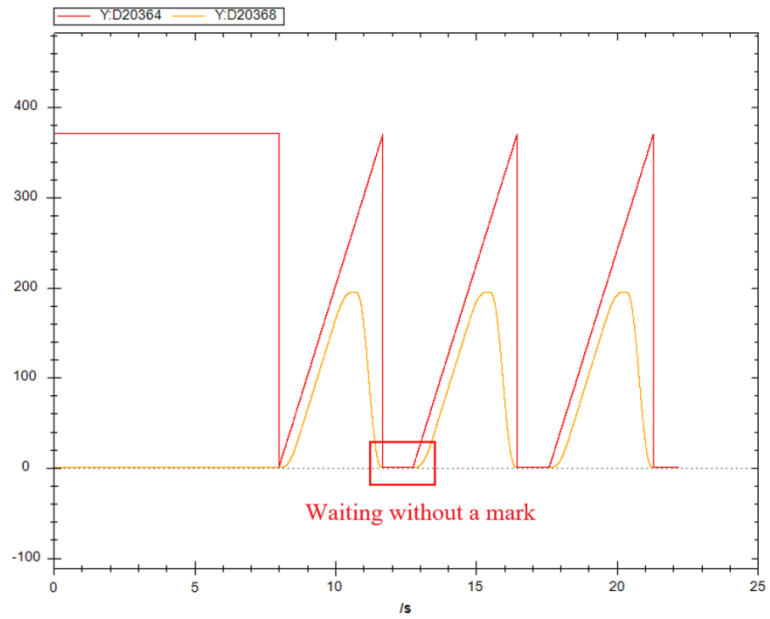
- Mislabeling: In variable-length materials, if the label spacing is shorter than the material length, it constitutes mislabeling.
- Color scale cut point spacing: The distance between color scale detection points and the cutting points. The cutting point during cutting pursuit corresponds to the start position of the synchronization zone. In actual production, any position within the synchronization zone can serve as the actual cutting point, customizable by the user. In both calibration and variable-length modes, the color scale cut point spacing must be set to ">material length" or "=0" (the cam table is activated immediately upon the first marker entering the queue).
- Probe 1 channel: 0: Probe 1, 1: Probe 2, 2: Probe 3, 3: Probe 4;
- Probe 1 Data Source: 0: Slave Station; 1: Master Station;
- Probe 1 trigger edge: 0: rising edge, 1: falling edge;
- Probe 1 trigger signal: 0: External; 1: Z-phase; 2–11: External interrupts X2–X13.
- Note: The parameter settings for Probe 1 are intended for the color-coded detection points on the spindle, and the variable-length mode must be enabled; detailed configuration requirements for the probe are specified in the "EtherCAT Motion Control User Manual."

Routine ：

Set the material length to 370. When the actual spacing is greater than or equal to 370, all markers will be properly aligned without any missing or misaligned markers.

Name	Monitor value	type	Map-Addres...	Comment
FS_FlyingShear_1		FS_Fly...		
strFollowCutParam		FS_INP...		Tracking input parameters
PacMode	2	UINT	SWord	shear mode
CompensationMode	0	UINT	SWord	compensation mode
CutLength	370	LREAL	QWord	and long
AccDist	75	LREAL	QWord	acceleration distance
SyncDist	120	LREAL	QWord	synchronous distances
DecDist	75	LREAL	QWord	deceleration distance
RevDist	0	LREAL	QWord	commutation distance
WaitDist	0	LREAL	QWord	waiting distance
SyncRatio	1	LREAL	QWord	Proportion of synchron...
ScrewRodLength	200	LREAL	QWord	screw stroke
TimeCut	0	LREAL	QWord	shearing time
ThicknessCutter	0	LREAL	QWord	Cutter thickness
VelocityBack	0	LREAL	QWord	return speed
ShearPhase	0	LREAL	QWord	shear phase
QueueSize	99	UINT	SWord	queue length
MarkSerialLost...	300	UINT	SWord	Upper limit for bid loss
MarkCutDistance	200	LREAL	QWord	color mark tangent poi...
MarkProtection...	0	LREAL	QWord	Color code protection ...
MeasuredCutLength	0	LREAL	QWord	Measured material length
strFollowCutInputBit		FS_INBIT		Tracking input status bit
strFollowCutInConfig		FS_INC...		Basic configuration of...
MasterSource	0	INT	SWord	spindle data source
SlaveMotorSpee...	3000	LREAL	QWord	Maximum speed from shaft
strProbeParam_FS		FS_PRO...		Tracking probe configu...
ProbeChannel1	0	UINT	SWord	Probe 1 Channel
ProbeSource1	1	UINT	SWord	Probe 1 Data Source
ProbeEdge1	0	UINT	SWord	Probe 1 trigger edge
ProbeSignal1	5	UINT	SWord	Probe 1 trigger signal
ZJ_OUTDATA		FS_OUT...		Tracking output data

Variable-length parameter instance



Master-slave motion phase diagram (D20364 represents the master axis phase, D20368 represents the slave axis phase)

2. Out parameter

Parameter Name	Data type	Explanatory note
CamIndexLoop	UINT	Chase the cam segment number of the loop section
CntMark	UINT	Current member count of the color scale queue: compare with the queue length specified by the input parameter
CntMarkTotal	UINT	Total number of test color codes
CntMarkSerialLost	UINT	Maximum consecutive discarded symbols: Compare with the input parameter's maximum discarded symbol limit
CntMarkIneffective	UINT	Invalid color code count: the number of color codes that do not meet the team entry criteria
CntCamPhase	UINT	Automatic compensation count
BackDist	LREAL	Return Distance
BestSyncDistance	LREAL	End-cut synchronization distance: Reserved parameter; not supported yet
MasterMotorSpeedLimit	LREAL	Maximum spindle speed: measured in RPM, calculated from the input parameter based on the shaft's maximum speed; an overspeed alarm is triggered when the spindle's set speed exceeds this value during operation.
MasterActMovementPerTum	LREAL	Actual spindle movement per revolution
Ready	BOOL	Set position: Set during the POU function block enable initialization phase
Busy	BOOL	Busy flag: Set during master-slave binding
InSync	BOOL	Synchronization position: Set when the cam is in the synchronization zone

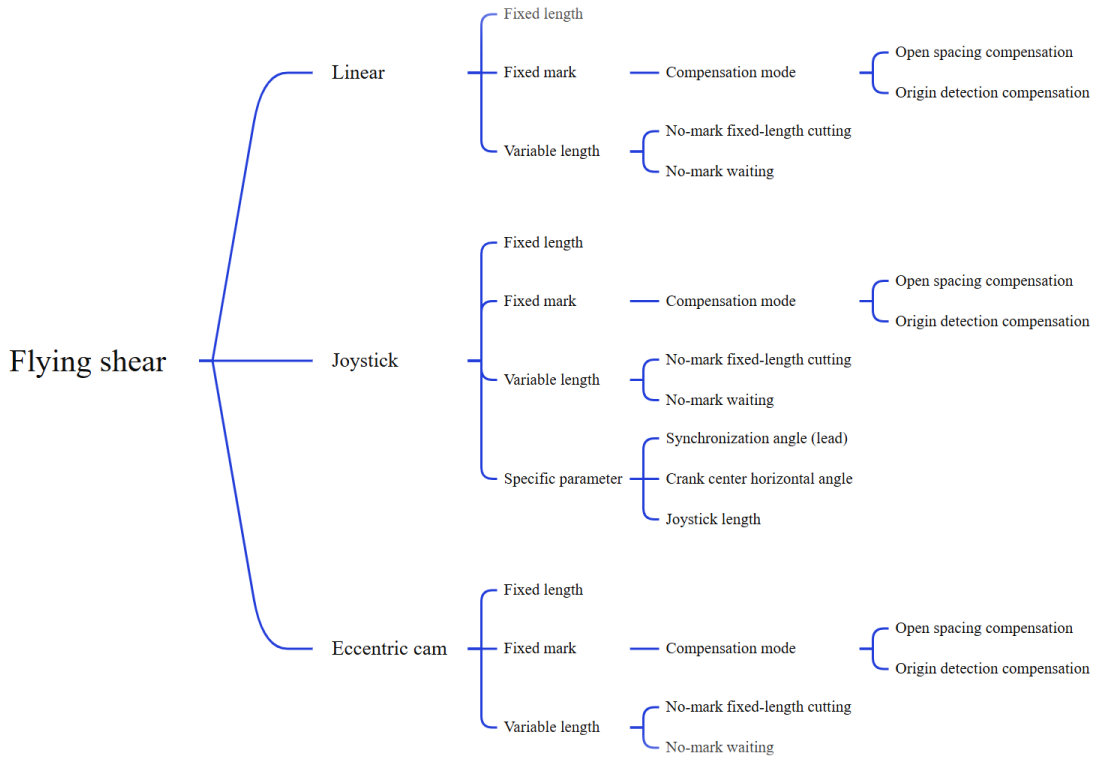
Aborted	BOOL	Rank: Cam breaks rear position
Error	BOOL	error bit
ErrorID	UINT	Error code, detailed later

3. Error Code

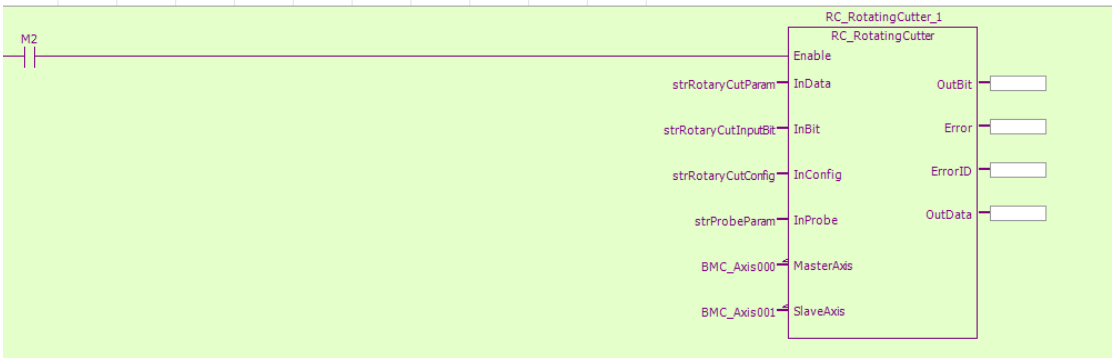
Chase cut error code	Error message
20000	Invalid configuration parameter
20001	Shearing mode error
20002	Bid rejected due to exceeding limits
20003	Excess speed alarm
20004	The axis is not enabled
20005	ERROR_CAMFASTTBLSEL
20006	ERROR_CAMTBLGEN
20007	ERROR_CAMIN
20008	ERROR_CAMWRMUL
20009	ERROR_PROBE
20010	ERROR_CAMPHASE_CAMADD
20100	Invalid trim parameters (material length, acceleration distance, synchronization distance, etc.)
20101	The maximum axial distance exceeds the screw travel.
20102	The color scale cutoff spacing is too small (should be greater than the material length or zero)
20103	Invalid compensation method for trailing cuts
20104	Error: Exceeding the maximum member count for the color scale queue or violating the discard limit
20105	Invalid value for the shadow color scale protection distance (valid value)
20106	Invalid probe configuration
20107	Incorrect fixed-length shear phase setting
20108	The color scale queue is too small

III. Flying Shear POU Usage Instructions

The flying shear features three synchronization modes: linear synchronization mode, crank-rocker synchronization mode, and eccentric wheel synchronization mode. Currently, the linear synchronization mode is predominantly used in field applications, while the crank-rocker and eccentric wheel modes are employed to meet specific process requirements. Each synchronization mode supports three cutting methods: fixed-length cutting, standard-length cutting, and variable-length cutting. Unlike the variable-length cutting method used in trailing shears—which only includes a standard waiting mode—the variable-length cutting method in the flying shear additionally offers a standard-length operation mode without standard parameters. Before activating the function block, the user must select and configure this variable-length operation mode.



Function Schematic Diagram



Function Block Diagram

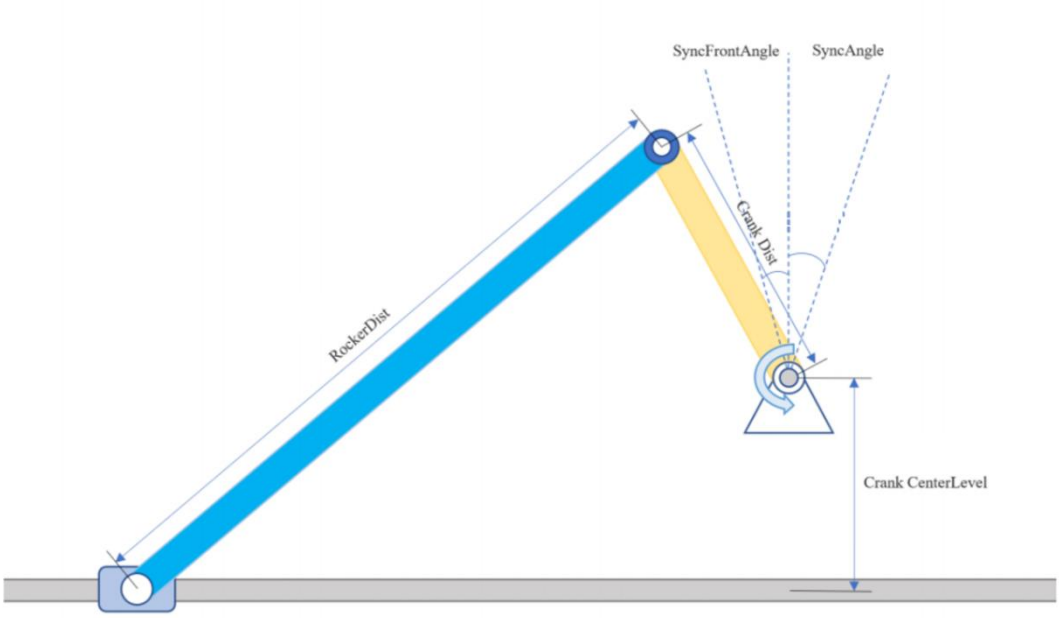
1. Input parameter

1.1 General Parameters

Parameter Name	Data type	Explanatory note
PacMode	UINT	Cut Mode
SyncMode	UINT	Synchronization Mode
NumberCutter	UINT	Number of scalpels
CutLength	LREAL	Material length
SyncAngle	LREAL	Synchronization Angle
SyncFrontAngle	LREAL	Sync Angle (Front): Used only in crank-rocker sync mode
SyncRatio	LREAL	Sync Zone Ratio
CrankCenterLevel	LREAL	Crank center height: Used only for the crank-rocker synchronization mode
RockerDist	LREAL	Joystick length: Used only for crank-rocker synchronization mode
MeasuredCutLength	LREAL	Measured material length
RunRotatingCutter	BOOL	Enable flag
StopRotatingCutter	BOOL	Stop flag bit
StopSlaveMotion	BOOL	Stop the axis
NoReset	BOOL	No reduction required
MasterSource	INT	Main spindle data source
SlaveMotorSpeedLimit	LREAL	Maximum shaft speed

- Cut mode: Used to switch the fly shear's cutting mode; 0: fixed-length cut, 1: fixed-scale cut, 2: variable-length cut;
- Synchronization mode: Used to switch the Fei Jian synchronization mode; 0: Linear synchronization, 1: Eccentric wheel synchronization, 2: Crank-rocker synchronization;
- Number of cutting blades: The number of blade heads used to cut the material from the rotating tool on the shaft, ranging from 1 to 4.
- Material length: The distance between color scales determined based on the color scale and its spacing at the application site.
- Synchronization Angle: The proportion of the synchronization area during the fly shear rotation from two adjacent shaft positions to the end positions; Linear synchronization and eccentric wheel synchronization refer to the total synchronization zone angle, while crank-rocker synchronization refers to the synchronization angle (later); for 1 cutting blades, the synchronization angle range is 1–359; for 2 blades, 1–179; for 3 blades, 1–119; and for 4 blades, 1–89.
- Sync angle (front): Used only in crank-rocker sync mode;
- Synchronization zone ratio: modifies the speed ratio between the shaft and the main shaft within the synchronization zone; range 0.6–1.4;

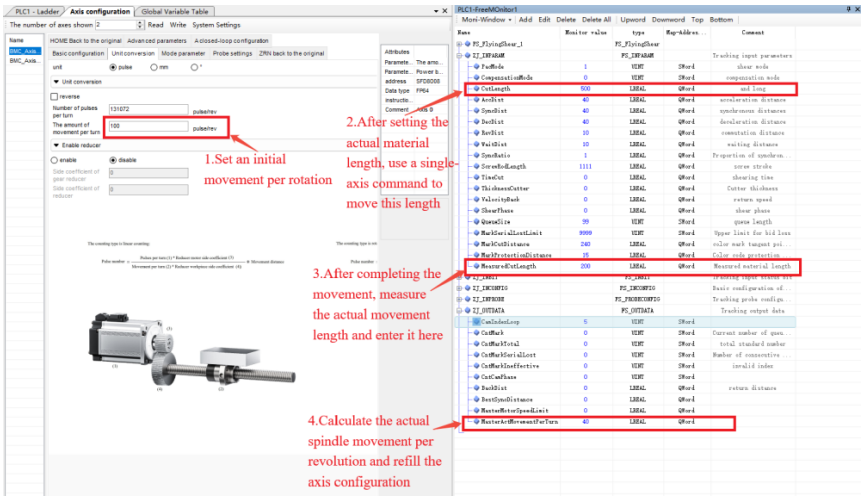
- Crank center height: Used only for the crank-rocker synchronization mode;
- Joystick length: Used only for the crank-rocker synchronization mode;



In the crank-rocker synchronous mode, the crank length is default set as the radius corresponding to the axial movement per revolution.

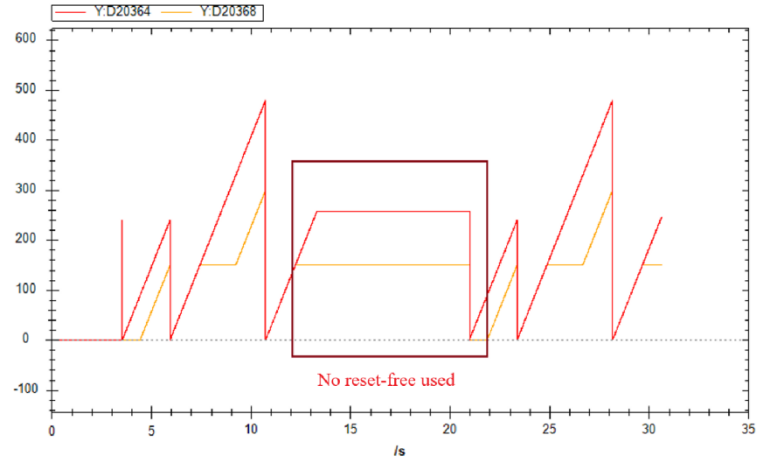
- Measured feed length: Used when the actual per-turn movement of the spindle is unknown. First, set an initial per-turn movement value so that the spindle advances a distance equal to the measured feed length. Using this initial value, the measured actual feed length, and the specified feed length, the spindle's actual per-turn movement can be calculated.

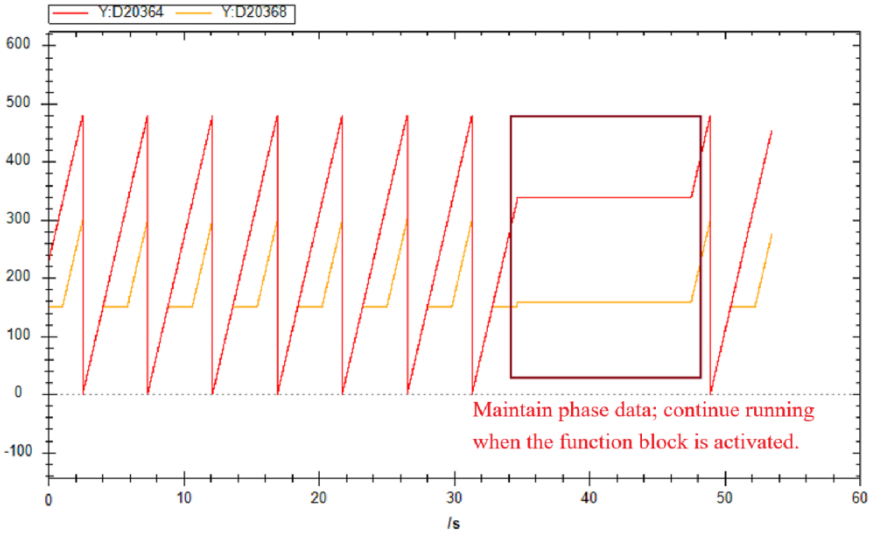
Note: This is a standard calculation function and does not require enabling POU.



- Enable flag: After completing the parameter settings for Fei Jian POU, first enable the POU, then set the enable flag to activate Fei Jian POU; this flag becomes effective upon rising edge detection.
- Stop flag: When the stop flag is set, the master-slave binding relationship is terminated at the end of the cycle, the slave axis stops, and the cam table instance is released; this flag is activated upon rising edge detection.

- Axis stop: After positioning at the stop axis, immediately remove the master-slave binding relationship, halt the slave axis, and release the cam table instance; the enabling effect of the flying shear POU command is similarly terminated; this flag becomes active upon rising edge detection.
- Reset-free: Continues the phase movement as before power-off. Before use, select the retention option for the function block in the global variable table to preserve internal data; during operation, activate the pilot channel function block first, then set the reset-free flag, and finally enable the activation flag.





- Spindle data source: The spindle data source bound to the axis motion; 0: Current spindle position specified; 1: Previous spindle position specified; 2: Current spindle position feedback; 3: Previous spindle position feedback. All cases discussed in this manual are written using the default parameter (0), where the current spindle position is specified.
- Maximum spindle speed: measured in RPM; used for internal calculation of the maximum spindle speed within POU. An overspeed alarm is triggered if the actual spindle speed exceeds the maximum value specified in POU output parameters.

Note: Parameters supporting real-time modification (effective in the next cycle): material length, synchronization angle, and synchronization zone ratio.

1.2 Constant-length shear (PacMode=0)

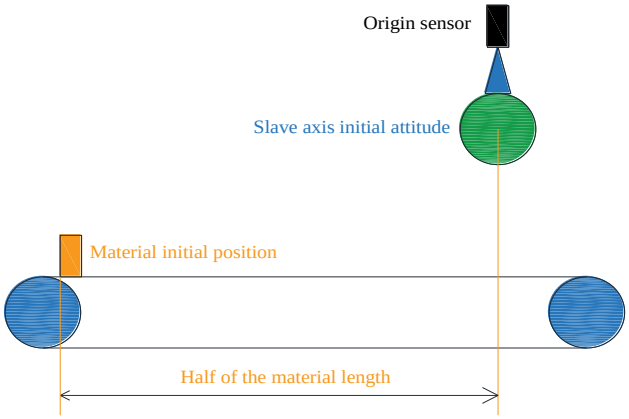
Cut at integer multiples of the set material length according to the color scale. When using fixed-length cutting, ensure consistent intervals between supplied materials' color scales and align the initial positions of the main and auxiliary spindles before operation.

Parameter Name	Data type	Explanatory note
ShearPhase	LREAL	Cut Phase

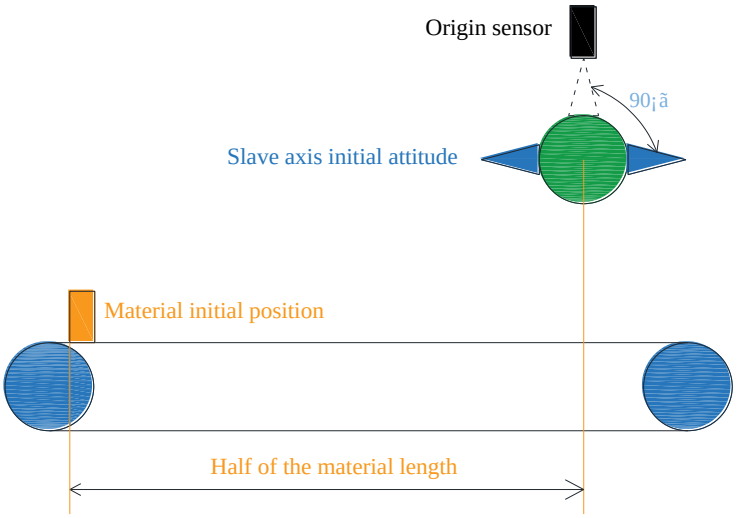
- Shearing Phase: Adjusts the offset of the cutting position relative to the main spindle axis. A positive value delays the cutting action by moving the spindle to its original cutting position plus the shearing phase, effectively delaying the cut; a negative value advances the cutting action by moving the spindle to its original cutting position minus the shearing phase, effectively advancing the cut. The shearing phase can be set within the range of ±material length.

Routine ：

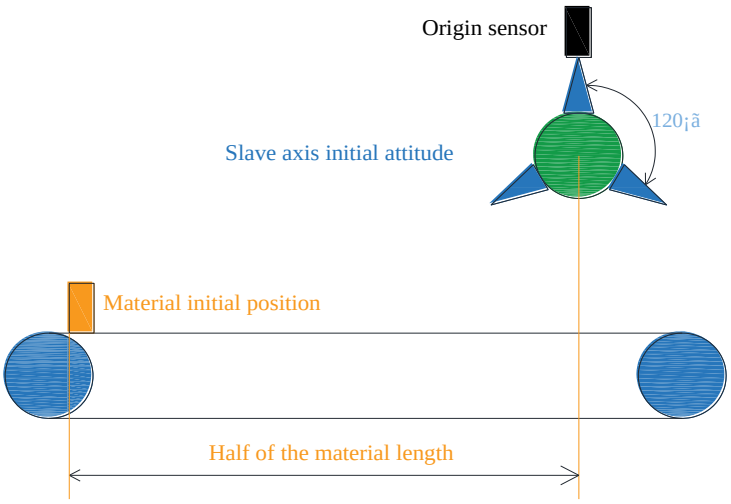
Note: For fixed-length cutting, align the machine with its initial position before the flying shear movement. The starting point of the material color scale should be located half the length of the material from the cutting point. The positions of the cutting heads are determined as the midpoint between two adjacent cutting points. Details are shown in the figure below:



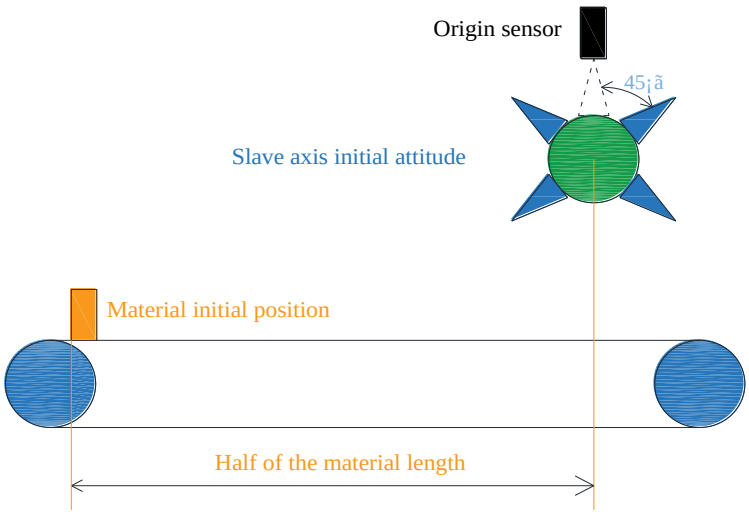
When the number of cutting blades is 1



When the number of cutting blades is 2



When the number of cutting blades is 3

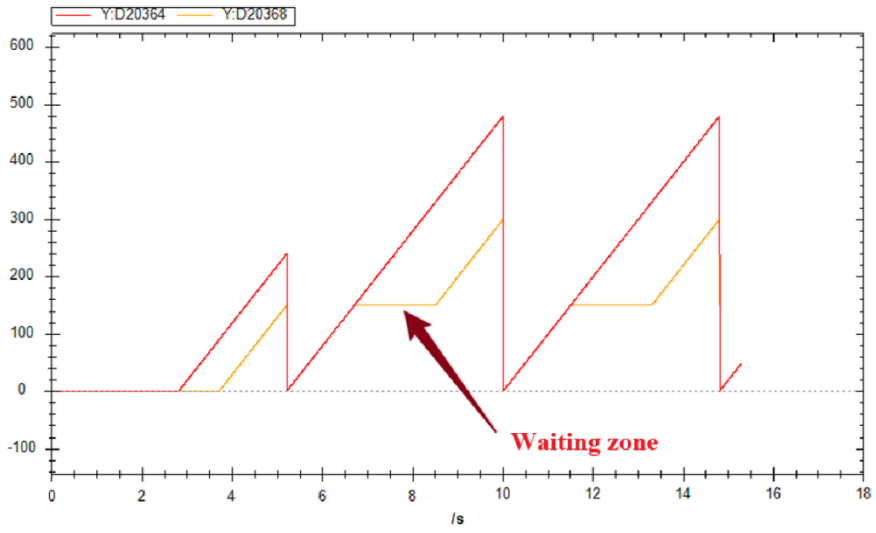


When the number of cutting blades is 4

For the following parameters: material length set to 480, synchronization angle 359 degrees, and synchronization zone ratio 1; during the actual test, the initial position of the color scale on the cam platform is located 240 mm from the cutting point, while the initial position of the cutting head is at the origin (since there is only one cutting head, the next adjacent cutting head is itself, so its position at the origin ensures that the cutting point lies at the midpoint between two adjacent cutting heads); the flying shear movement begins by first advancing the spindle half the material length before initiating cutting—this serves as the purpose of initial posture adjustment to ensure precise color-scale cutting thereafter.

Name	Monitor value	type	Map-Addres...	Comment
strRotaryCutParam		RC_INP...		Rotary cutting input p...
PacMode	0	UINT	SWord	Cutting mode (fixed le...
SyncMode	0	UINT	SWord	Synchronous mode (line...
CompensationMode	0	UINT	SWord	Compensation mode (mar...
VarLenMode	1	UINT	SWord	Variable length mode (...
NumberCutter	480	UINT	SWord	Number of cutters
CutLength	359	LREAL	QWord	and long
SyncAngle	0	LREAL	QWord	synchronous angle
SyncFrontAngle	1	LREAL	QWord	Synchronization angle ...
SyncRatio	0	LREAL	QWord	Proportion of synchron...
ShearPhase	0	LREAL	QWord	shear phase
QueueSize	0	UINT	SWord	queue length
MarkSerialLost...	0	UINT	SWord	Upper limit for bid loss
MarkCutDistance	0	LREAL	QWord	color mark tangent poi...
MarkProtection...	0	LREAL	QWord	Color code protection ...
OriginSignalOf...	0	LREAL	QWord	origin signal offset
CrankCenterLevel	0	LREAL	QWord	crank center height
RockerDist	0	LREAL	QWord	rocker length
AngleReversal	0	LREAL	QWord	inverse angle
TimeReversal	0	LREAL	QWord	inversion time
NumCutLengthSk...	0	LREAL	QWord	Number of delivery pac...
MeasuredCutLength	0	LREAL	QWord	Measured material length

Fixed-length parameter example



Master-slave motion phase diagram (D20364 represents the master axis phase, D20368 represents the slave axis phase)

1.3 Calibration Shearing (PacMode=1)

Fixed-length cutting: When the color code detection point identifies the first color code, the flying shear prepares to initiate operation. After cutting the first color code, subsequent codes are processed using a fixed-length cutting method, allowing their positions to vary within ± the color code protection distance from an integer multiple of the material length (i.e., valid codes). If no code is detected within this range, cutting proceeds normally along the axis, but the code count is discarded; if the discard threshold POU is exceeded, an error is reported. Due to the permissible positional variation of color codes, phase compensation is

implemented during the flying shear's movement.

Parameter Name	Data type	Explanatory note
CompensationMode	UINT	Compensation Mode
ShearPhase	LREAL	Cut Phase
QueueSize	UINT	queue length
MarkSerialLostLimt	UINT	Bid loss ceiling
MarkCutDistance	LREAL	Color scale cutoff interval
MarkProtectionDistance	LREAL	Color scale protection distance
OriginSignalOffset	LREAL	Origin signal offset; not supported
AngleReversal	LREAL	Reverse angle: typically half of the axis period length; not supported currently
TimeReversal	LREAL	Reversal time: typically 1−5 seconds; not supported currently
NumCutLengthSkipped	LREAL	Number of material packages: usually 1−10; not supported currently
ProbeChannel1	UINT	Probe Channel 1
ProbeChannel2	UINT	Probe 2-channel (only Compensation Mode 1)
ProbeSource1	UINT	Probe 1 Data Source
ProbeSource2	UINT	Probe 2 data source (only Compensation Mode 1)
ProbeEdge1	UINT	Probe 1 trigger edge
ProbeEdge2	UINT	Probe 2 trigger edge (only Compensation Mode 1)
ProbeSignal1	UINT	Probe 1 trigger signal
ProbeSignal2	UINT	Probe 2 trigger signal (only Compensation Mode 1)

- Compensation Mode:

 Compensation Mode 0: By calculating the difference in color scale latch positions obtained through color scale position latching, the distance between each pair of adjacent targets is determined. This distance is then compared with the material length to compute the compensation amount.

 Compensation Mode 1 (Origin Signal Compensation): The spindle cycle length for the next period is calculated by combining the spindle position recorded during origin signal detection, the latch position of the current post's subsequent color code, and the distance between color code cut-off points. This can also be interpreted as the distance between adjacent color codes. In cases of missing color codes, due to the fixed-length movement characteristic without color codes, the

system assumes that the current color code position maintains an integer multiple relationship with the previous valid color code position and records this relationship.

- Shearing Phase: Adjusts the offset of the cutting position relative to the main spindle axis. A positive value delays the cutting action by moving the spindle to its original cutting position plus the shearing phase, effectively delaying the cut; a negative value advances the cutting action by moving the spindle to its original cutting position minus the shearing phase, effectively advancing the cut. The shearing phase can be set within the range of ±material length.
- Queue length: Valid labels are added to the queue; in calibration mode, a valid label is one whose spacing from the preceding valid label is an integer multiple of the material length ± the color code protection distance; the current valid label is removed from the queue when its position is adjusted in advance via the POU's internal CAMADD instruction or write point; the maximum queue length is 99.
- Maximum lost mark limit: A predefined continuous maximum number of lost marks compared with the output parameter's maximum consecutive lost mark count (CntMarkSerialLost). During calibration trimming, no color code appears within the valid mark range is counted as a lost mark. The calibration trimming follows a fixed-length approach—even without any marks, trimming occurs.

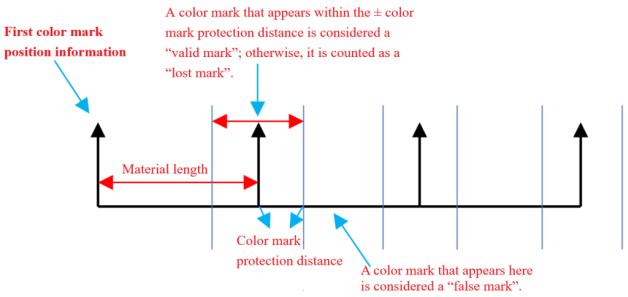
Mislabel: During cyclic operation, if a label appears outside the valid label range, it is considered a mislabel. The categories of color labels include valid labels, lost labels, and mis labels.

- Color scale cut point spacing: The distance between color scale detection points and the cutting points. In Fei Jian, the cut points are typically the lowest positions on the shaft's rotating wheel. In both fixed-scale and variable-length modes, this spacing must be set to ">material length" or "=0" (the cam table activates immediately upon the first marker entering the line).
- Color code protection distance: The floating range of the valid mark; marks within ± integer multiples of the material length within this distance are considered valid; typically 10–20 mm; if set too large, axial motion compensation cannot ensure stability.
- Probe 1 channel: 0: Probe 1, 1: Probe 2, 2: Probe 3, 3: Probe 4;
- Probe 2 channel: Parameter selection is the same as for Probe 1 channel, with only Compensation Mode 1 being valid.
- Probe 1 Data Source: 0: Slave Station; 1: Master Station;
- Probe 2 data source: Parameter selection is the same as for Probe 1; only Compensation Mode 1 is valid.
- Probe 1 trigger edge: 0: rising edge, 1: falling edge;
- Probe 2 trigger edge: Parameter selection is the same as for Probe 1 trigger edge, with only Compensation Mode 1 being valid.
- Probe 1 trigger signal: 0: External; 1: Z-phase; 2–11: External interrupts X2–X13.
- Probe 2 trigger signal: Parameter selection is the same as for Probe 1, with only Compensation Mode 1 being active.

Note: The parameter settings for Probe 1 are used for the color-coded detection points on the spindle, and the calibration mode must be configured; the parameter settings for Probe 2 are used for the origin detection on the spindle, and must be configured in Compensation Mode 1. For

detailed configuration of probes, refer to the "EtherCAT Motion Control User Manual."

- Color Scale Definition Chart

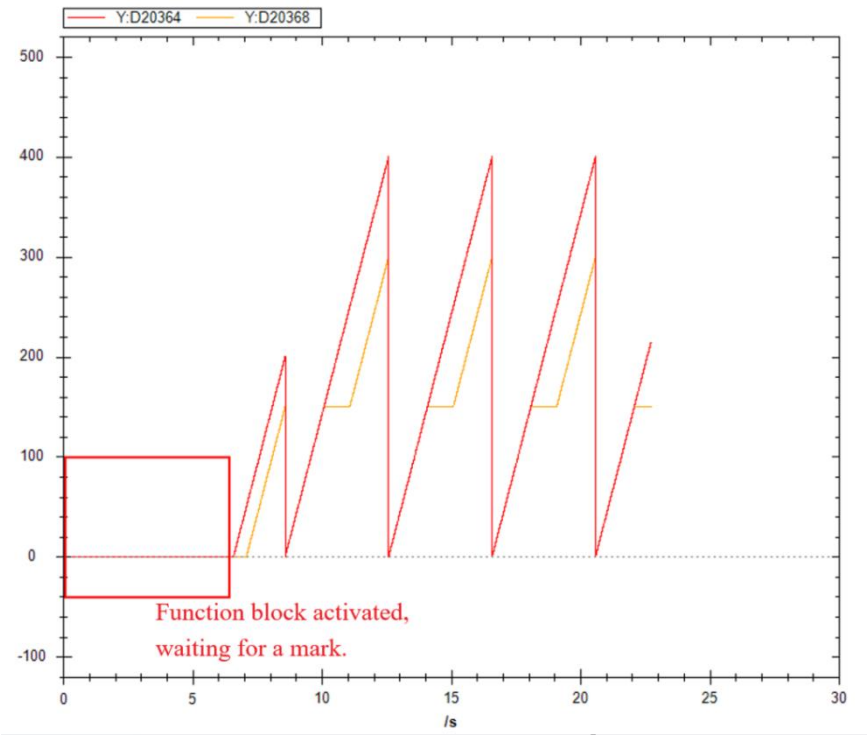


Routine ：

In the test cam platform, the distance between the main shaft color-coded detection points and the flying shear point is 240 mm, which corresponds to the spacing of the color-coded cutting points. The input signal for these detection points is the normally open signal from terminal X4 of the master PLC, requiring corresponding parameter configuration for Probe 1. For this calibration case employing Compensation Mode 1, an origin signal must be configured; specifically, the origin signal for the flying shear on the cam platform originates from terminal X3 of the master PLC, necessitating parameter adjustment for Probe 2.

Name	Monitor value	type	Map-Addres...	Comment
strRotaryCutParam		RC_INP...		Rotary cutting input p...
PacMode	1	UINT	SWord	Cutting mode (fixed le...
SyncMode	0	UINT	SWord	Synchronous mode (line...
CompensationMode	1	UINT	SWord	Compensation mode (mar...
VarLenMode	0	UINT	SWord	Variable length mode (...
NumberCutter	1	UINT	SWord	Number of cutters
CutLength	400	LREAL	QWord	and long
SyncAngle	359	LREAL	QWord	synchronous angle
SyncFrontAngle	0	LREAL	QWord	Synchronization angle ...
SyncRatio	1	LREAL	QWord	Proportion of synchron...
ShearPhase	0	LREAL	QWord	shear phase
QueueSize	99	UINT	SWord	queue length
MarkSerialLost...	300	UINT	SWord	Upper limit for bid loss
MarkCutDistance	240	LREAL	QWord	color mark tangent poi...
MarkProtection...	20	LREAL	QWord	Color code protection ...
OriginSignalOf...	0	LREAL	QWord	origin signal offset
CrankCenterLevel	0	LREAL	QWord	crank center height
RockerDist	0	LREAL	QWord	rocker length
AngleReversal	0	LREAL	QWord	inverse angle
TimeReversal	0	LREAL	QWord	inversion time
NumCutLengthSk...	0	LREAL	QWord	Number of delivery pac...
MeasuredCutLength	0	LREAL	QWord	Measured material length
strRotaryCutInputBit		RC_INBIT		Rotary input status bit
strRotaryCutConfig		RC_INC...		Rotary cutting foundat...
MasterSource	0	INT	SWord	spindle data source
SlaveMotorSpee...	3000	LREAL	QWord	Maximum speed from shaft
strProbeParam		RC_PRO...		probe arrangement
ProbeChannel1	0	UINT	SWord	Probe 1 Channel
ProbeChannel2	1	UINT	SWord	Probe 2 Channel
ProbeSource1	1	UINT	SWord	Probe 1 Data Source
ProbeSource2	1	UINT	SWord	Probe 2 Data Source
ProbeEdge1	0	UINT	SWord	Probe 1 trigger edge
ProbeEdge2	0	UINT	SWord	Probe 2 trigger edge
ProbeSignal1	4	UINT	SWord	Probe 1 trigger signal
ProbeSignal2	3	UINT	SWord	Probe 2 trigger signal

Example of calibration parameters



Master-slave motion phase diagram (D20364 represents the master axis phase, D20368 represents the slave axis phase)

1.4 Variable-length shear (PacMode=2)

Unlike conventional cutting, the fly shear's variable-length cutting mode comprises two variants: variable-length non-standard waiting and variable-length non-standard fixed-length cutting. The variable-length non-standard waiting variant involves standard cutting followed by non-standard waiting; the variable-length non-standard fixed-length cutting variant involves standard cutting followed by non-standard cutting at integer multiples of the material length. Notably, the variable-length non-standard fixed-length cutting differs from standard fixed-length cutting in that it disregards discarded cutting marks and does not support color mark protection distances.

Parameter Name	Data type	Explanatory note
VarLenMode	UINT	Variable Length Mode
QueueSize	UINT	queue length
MarkSerialLostLimt	UINT	Bid loss ceiling
MarkCutDistance	LREAL	Color scale cutoff interval
ProbeChannel1	UINT	Probe Channel 1
ProbeSource1	UINT	Probe 1 Data Source
ProbeEdge1	UINT	Probe 1 trigger edge
ProbeSignal1	UINT	Probe 1 trigger signal

- Variable-length mode: Used to select the operation mode for shearing in variable-length, unmarked states; 0: Wait for variable-length, unmarked states; 1: Perform fixed-length shearing for variable-length, unmarked states.
- Queue length: Marks with a length exceeding the material length are added to the queue; in the variable-length cutting mode, the current mark detected by the color code sensor is

positioned more than the set material length away from the previous valid mark; the current valid mark is removed from the queue when its position is adjusted in advance via the POU's internal CAMADD instruction or write-point operation; the maximum queue length is 99.

- Maximum loss limit: A predefined continuous loss limit that compares against the maximum consecutive lost mark count (CntMarkSerialLost) in output parameters. In variable-length truncation, no loss markers exist—only valid and erroneous marks. Currently, a set value is required to run POU.

Mislabeling: In variable-length materials, if the label spacing is shorter than the material length, it constitutes mislabeling.

- Color scale cut point spacing: The distance between color scale detection points and the cutting points. In Fei Jian, the cut points are typically the lowest positions on the rotating wheel of the axis. In both fixed-scale and variable-length modes, this parameter must be set to ">material length" or "0" (the cam table activates immediately upon the first mark entering the line).
- Probe 1 channel: 0: Probe 1, 1: Probe 2, 2: Probe 3, 3: Probe 4;
- Probe 1 Data Source: 0: Slave Station; 1: Master Station;
- Probe 1 trigger edge: 0: rising edge, 1: falling edge;
- Probe 1 trigger signal: 0: External; 1: Z-phase; 2–11: External interrupts X2–X13.
- Note: The parameter settings for Probe 1 are intended for the color-coded detection points on the spindle, and the variable-length mode must be enabled; detailed configuration requirements for the probe are specified in the "EtherCAT Motion Control User Manual."

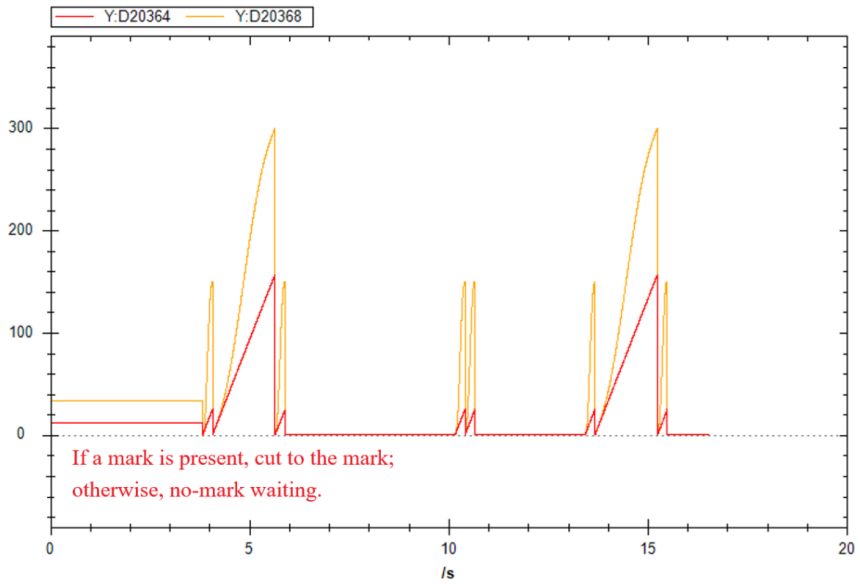
Routine ：

Variable-length no-mark waiting mode:

Set the material length to 50. If the actual marking interval is greater than or equal to 50, all color scales can be cut accurately. If the marking interval is less than 50, the subsequent marking will be mismarked; no markings will be missed. The detection point distance between the test cam platform color scales and the flying shear at the axis-cutting point is 240 mm (i.e., the color scale cutting interval).

Name	Monitor value	type	Map-Addres...	Comment
strRotaryCutParam		RC_INP...		Rotary cutting input p...
PacMode	2	UINT	SWord	Cutting mode (fixed le...
SyncMode	0	UINT	SWord	Synchronous mode (line...
CompensationMode	0	UINT	SWord	Compensation mode (mar...
VarLenMode	0	UINT	SWord	Variable length mode (...
NumberCutter	1	UINT	SWord	Number of cutters
CutLength	50	LREAL	QWord	and long
SyncAngle	1	LREAL	QWord	synchronous angle
SyncFrontAngle	0	LREAL	QWord	Synchronization angle ...
SyncRatio	1	LREAL	QWord	Proportion of synchron...
ShearPhase	0	LREAL	QWord	shear phase
QueueSize	99	UINT	SWord	queue length
MarkSerialLost...	300	UINT	SWord	Upper limit for bid loss
MarkCutDistance	240	LREAL	QWord	color mark tangent poi...
MarkProtection...	0	LREAL	QWord	Color code protection ...
OriginSignalOf...	0	LREAL	QWord	origin signal offset
CrankCenterLevel	0	LREAL	QWord	crank center height
RockerDist	0	LREAL	QWord	rocker length
AngleReversal	0	LREAL	QWord	inverse angle
TimeReversal	0	LREAL	QWord	inversion time
NumCutLengthSk...	0	LREAL	QWord	Number of delivery pac...
MeasuredCutLength	0	LREAL	QWord	Measured material length
strRotaryCutInputBit		RC_INBIT		Rotary input status bit
strRotaryCutConfig		RC_INC...		Rotary cutting foundat...
strProbeParam		RC_PRO...		probe arrangement
ProbeChannel1	0	UINT	SWord	Probe 1 Channel
ProbeChannel2	0	UINT	SWord	Probe 2 Channel
ProbeSource1	1	UINT	SWord	Probe 1 Data Source
ProbeSource2	0	UINT	SWord	Probe 2 Data Source
ProbeEdge1	0	UINT	SWord	Probe 1 trigger edge
ProbeEdge2	0	UINT	SWord	Probe 2 trigger edge
ProbeSignal1	4	UINT	SWord	Probe 1 trigger signal
ProbeSignal2	0	UINT	SWord	Probe 2 trigger signal

Example of an indefinite-length non-standard wait parameter



Master-slave motion phase diagram (D20364 represents the master axis phase, D20368 represents the slave axis phase)

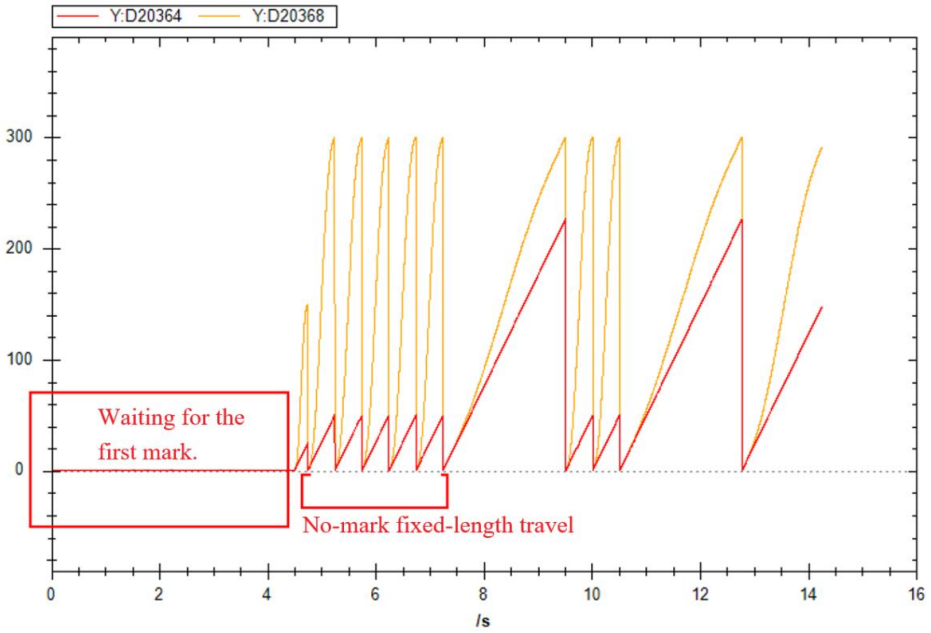
Unfixed-length non-standard walking to fixed-length:

Based on the aforementioned variable-length, non-standardized waiting parameter, simply change

the variable-length mode (set to 1) to activate the variable-length, non-standardized fixed-length cutting mode.

Name	Monitor value	type	Map-Addres...	Comment
strRotaryCutParam		RC_INP...		Rotary cutting input p...
PacMode	2	UINT	SWord	Cutting mode (fixed le...
SyncMode	0	UINT	SWord	Synchronous mode (line...
CompensationMode	0	UINT	SWord	Compensation mode (mar...
VarLenMode	1	UINT	SWord	Variable length mode (...
NumberCutter	1	UINT	SWord	Number of cutters
CutLength	50	LREAL	QWord	and long
SyncAngle	1	LREAL	QWord	synchronous angle
SyncFrontAngle	0	LREAL	QWord	Synchronization angle ...
SyncRatio	1	LREAL	QWord	Proportion of synchron...
ShearPhase	0	LREAL	QWord	shear phase
QueueSize	99	UINT	SWord	queue length
MarkSerialLost...	300	UINT	SWord	Upper limit for bid loss
MarkCutDistance	240	LREAL	QWord	color mark tangent poi...
MarkProtection...	0	LREAL	QWord	Color code protection ...
OriginSignalOf...	0	LREAL	QWord	origin signal offset
CrankCenterLevel	0	LREAL	QWord	crank center height
RockerDist	0	LREAL	QWord	rocker length
AngleReversal	0	LREAL	QWord	inverse angle
TimeReversal	0	LREAL	QWord	inversion time
NumCutLengthSk...	0	LREAL	QWord	Number of delivery pac...
MeasuredCutLength	0	LREAL	QWord	Measured material length
strRotaryCutInputBit		RC_INBIT		Rotary input status bit
strRotaryCutConfig		RC_INC...		Rotary cutting foundat...
strProbeParam		RC_PRO...		probe arrangement
ProbeChannel1	0	UINT	SWord	Probe 1 Channel
ProbeChannel2	0	UINT	SWord	Probe 2 Channel
ProbeSource1	1	UINT	SWord	Probe 1 Data Source
ProbeSource2	0	UINT	SWord	Probe 2 Data Source
ProbeEdge1	0	UINT	SWord	Probe 1 trigger edge
ProbeEdge2	0	UINT	SWord	Probe 2 trigger edge
ProbeSignal1	4	UINT	SWord	Probe 1 trigger signal
ProbeSignal2	0	UINT	SWord	Probe 2 trigger signal

Example of a variable-length, non-standardized string with fixed-length parameters



Master-slave motion phase diagram (D20364 represents the master axis phase, D20368 represents the slave axis phase)

2. Output Parameters

Variable Name	Number Type	Explanatory note
CamIndexStart	UINT	Flap-cut startup segment cam segment number
CamIndexLoop	UINT	Flap-cutting cycle section cam surface segment number
CamIndexStop	UINT	End segment cam number for the shear flap
CntMark	UINT	Current member count of the color scale queue: compare with the queue length specified by the input parameter
CntMarkTotal	UINT	Total number of test color codes
CntMarkSerialLost	UINT	Maximum consecutive discarded symbols: Compare with the input parameter's maximum discarded symbol limit
CntMarkIneffective	UINT	Invalid color code count: the number of color codes that do not meet the team entry criteria
CntCamPhase	UINT	Automatic compensation count
MasterActMovementPerTum	LREAL	Actual spindle movement per revolution
MasterMotorSpeedLimit	LREAL	Maximum spindle speed: measured in RPM, calculated from the input parameter based on the shaft's maximum speed; an overspeed alarm is triggered when the spindle's set speed exceeds this value during operation.
AngleBehindMax	LREAL	The maximum crank-rocker angle (after) is typically selected between 10° and 80°, and should be less than its maximum value.
AngleFrontMax	LREAL	The maximum crank-rocker angle (front) is typically selected between 10° and 80°, and should be less than its maximum value.

Ready	BOOL	Set position: Set during the POU function block enable initialization phase
Busy	BOOL	Busy flag: Set during master-slave binding
InSync	BOOL	Synchronization position: Set when the cam is in the synchronization zone
Aborted	BOOL	Rank: Cam breaks rear position
Error	BOOL	error bit
ErrorID	UINT	Error code, detailed later

3. Error Code

Chase cut error code	Error message
20000	Invalid configuration parameter
20001	Shearing mode error
20002	Bid rejected due to exceeding limits
20003	Excess speed alarm
20004	The axis is not enabled
20005	ERROR_CAMFASTTBLSEL
20006	ERROR_CAMTBLGEN
20007	ERROR_CAMIN
20008	ERROR_CAMWRMUL
20009	ERROR_PROBE
20010	ERROR_CAMPHASE_CAMADD
20200	Invalid selection for the shear-cut synchronization mode
20201	Invalid basic parameters for the shear blade (material length, number of blades, etc.)
20202	The synchronization angle setting for the shear-cut crank and rocker is too large.
20203	The cut point spacing of the shear flap color scale is too small (should be greater than the material length or zero).
20204	Invalid shear compensation method
20205	Maximum member count or label discard limit error in the Flash Cut color scale queue
20206	Invalid value for the shear-cut color scale protection distance (effective value)
20207	Invalid shear probe configuration
20208	Invalid additional parameters for the shear-cut crank-rocker mechanism

20209	The shear-cut crank-rocker rod is slightly too short.
20210	The synchronization angle setting for the shear-cut crank and rocker is too large.
20211	The shear flap crank-rocker cutter supports only one blade.
20212	Incorrect fixed-length shear phase setting
20213	The color scale queue is too small