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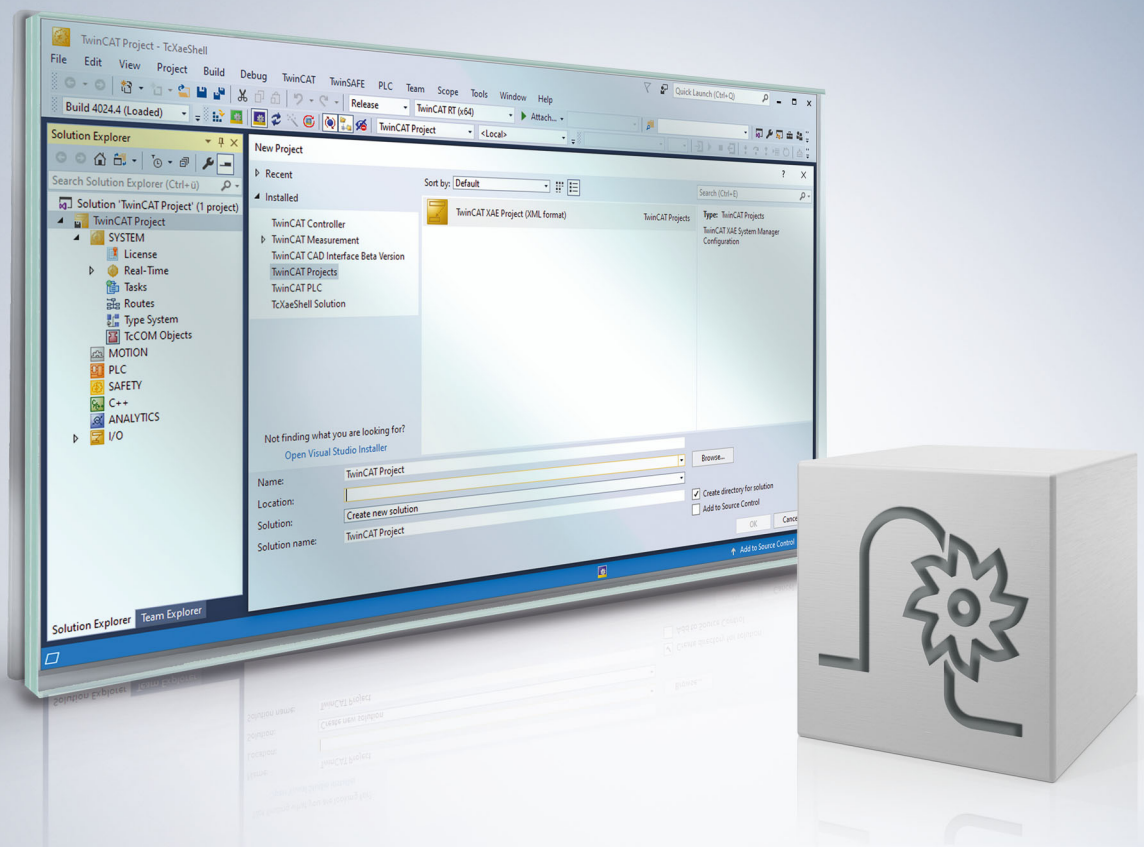
Functional description | EN

TF5200 | TwinCAT 3 CNC

Homing



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Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.
It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

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General and safety instructions

Icons used and their meanings

This documentation uses the following icons next to the safety instruction and the associated text. Please read the (safety) instructions carefully and comply with them at all times.

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1. Indicates an action.

⇨ Indicates an action statement.

⚠ DANGER

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If you fail to comply with the safety instruction next to this icon, it may result in personal injury or damage to machines.

NOTICE

Restriction or error

This icon describes restrictions or warns of errors.

Tips and other notes

This icon indicates information to assist in general understanding or to provide additional information.

General example

Example that clarifies the text.

NC programming example

Programming example (complete NC program or program sequence) of the described function or NC command.

Specific version information

Optional or restricted function. The availability of this function depends on the configuration and the scope of the version.

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1 Overview

Task

To home a machine axis, the actual position value system of the machine axis must be synchronised

- with the axis coordinate system of the machine and
- the CNC.

Characteristics

All machine axes that must be positioned and have no encoder (which supplies an actual value absolute position) must be homed.

Speed-controlled or only endlessly position-controlled spindles need not be homed.

Homing (RPF) is possible for the following axis types (P-AXIS-00018):

- Linear axes
- Rotary axes
- Spindles

Parameterisation

Homing must be parameterised for every axis in the axis parameter list.

For more information on this function, see the chapter Parameterisation [▶ 39].

Programming

Homing is commanded with by the NC command G74 or by starting the 'Homing' mode.

Mandatory note on references to other documents

For the sake of clarity, links to other documents and parameters are abbreviated, e.g. [PROG] for the Programming Manual or P-AXIS-00001 for an axis parameter.

For technical reasons, these links only function in the Online Help (HTML5, CHM) but not in pdf files since pdfs do not support cross-linking.

2 Description

Task of homing

The actual position value system of a machine axis is synchronised with the machine geometry by homing.

Homing means: Synchronising axis initialisation with the required axis coordinate system.

Homing refers to the entire process including referencing up to axis standstill.

NOTICE

Only when homing is completed are the software limit switch position of the axes monitored.

Homing is always executed at line slope speed profile.

Axis position after homing

After homing is complete, the axis is not located at its reference point. The reason for this is that, when the cam/zero pulse signal occurs, the reference position is adopted and the axis is then decelerated. At the end of homing, the axis is then located at the deceleration distance away from the reference position.

Absolute measuring system or incremental measuring system

Machine axes need not be homed if they are equipped with an absolute measuring system which supplies a unique axis or slide position in the entire motion range of the drive. This can be set by the axis parameter P-AXIS-00014 (abs_pos-_gueltig).

NOTICE

Homing is required for incremental measuring systems. This is obtained by setting the axis parameter P-AXIS-00014 (abs_pos_gueltig) to 0. The homing that is then required is described in detail below.

Homing strategies

The following strategies can be executed with the controller to home an axis.

- Homing with reference cam, reference with zero pulse
- Homing with reference cam, reference with cam (without zero pulse)
- Referencing (without reference cam) with zero pulse
- Homing with fast and slow reversal

Reference cam

The reference cam executes a pre-positioning and precise homing is then executed with the zero pulse from the encoder. A cam switch determines whether the axis is located on or next to the cam.

It is also possible to reference with cam without zero impulse. For example, this is a standard method with stepper motors in addition to referencing with “Move to fixed stop”.

Repeatability with referencing

Depending on the homing strategy and the hardware used, latching the axis position is executed either by the cam signal or the zero pulse. This permits exact speed-independent referencing.

If the hardware used does not support this, the homing accuracy is dependent on the speed at which motion takes place on the cam.

If the homing speed is selected, the maximum tolerance results from the sampling time of the function which executes position and cam detection.

For example, a maximum deviation of 200 µm results from a homing speed of 6 m/min and a sampling rate of 2ms.

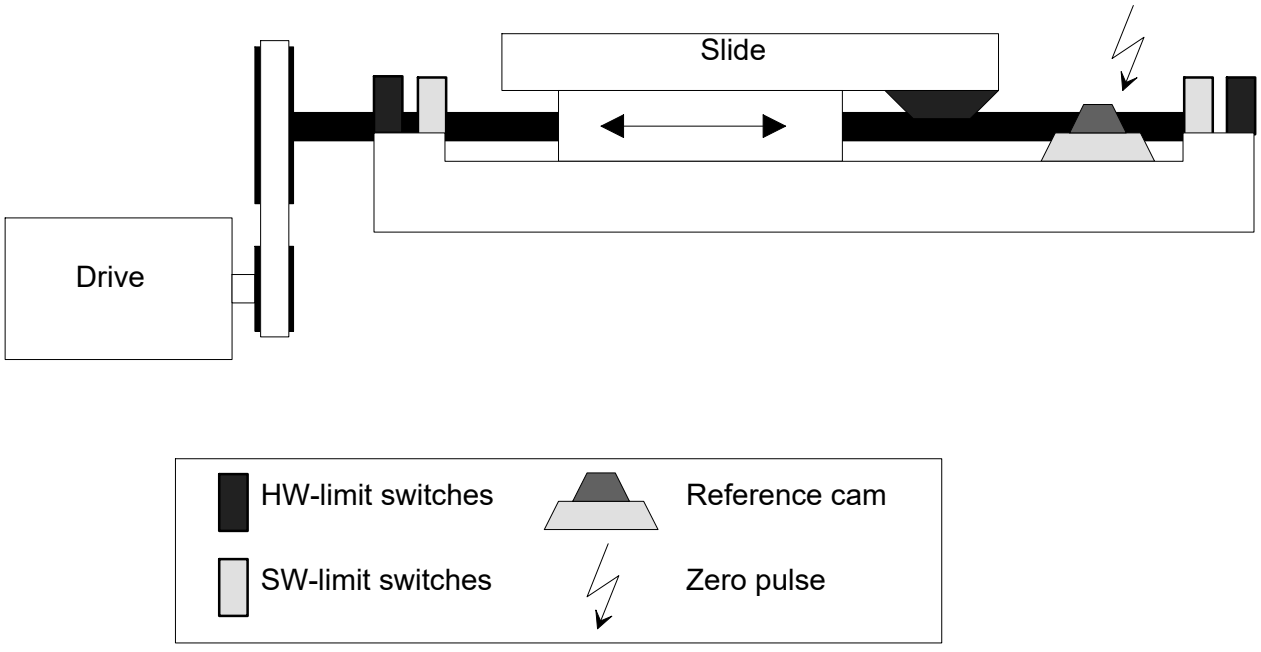

Fig. 1: Principle layout of limit switches and reference cam of a machine axis

Zero pulse encoder

After pre-positioning with a reference cam, referencing can be executed very precisely with a zero pulse encoder if the hardware supports latching the counter state when the zero pulse is received. In this case, the repeatability of referencing depends on the homing speed. It is also possible to reference with only one pulse which may occur once in the motion range and is therefore unique. This is often used with rotary axes.

Fitting the zero pulse encoder

The search for a zero pulse is only activated by the NC kernel if the reference cam is operated. The encoder should therefore be fitted so that the zero pulse occurs about half an encoder rotation after the cam is operated. This produces reproducible referencing.

If the zero pulse occurs simultaneously with the cam, the zero pulse is either detected or not depending on whether the reference cam is operated before or after the zero pulse occurs. Axis referencing can then by shifted by one encoder rotation.

2.1 Homing interfaces

The figure shows the NC controller with its interfaces related to homing. Homing the assigned axes can be commanded in the individual channels either in

- “Homing” mode or with the
- NC command G74

in the NC program. Homing must be parameterised for every NC axis in the axis parameter list.

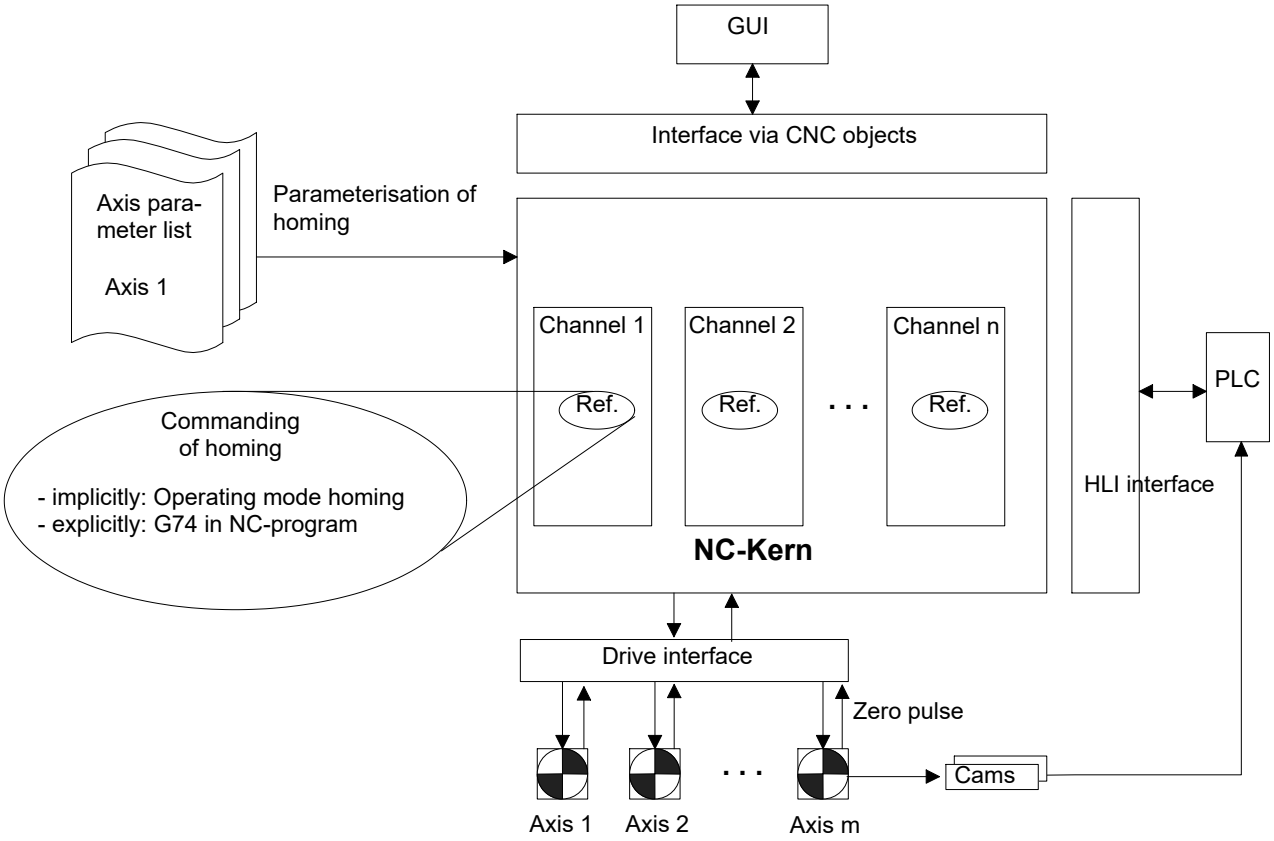

Fig. 2: Overview of NC controller

CNC interface

Referring to homing, the CNC has an object interface for the

- GUI to command homing and
- to request the axis status from the controller.

HLI interface

The HLI interface is a memory-coupled interface for the NC controller to communicate with the PLC. This interface is described in detail in [HLI]. The HLI interface is used to:

- command homing and
- request the axis status.

The cam signal is supplied to the NC via the HLI interface,. The periphery reads the cam signal and writes the signal to the HLI interface. This is executed in the PLC (see also [HLI]).

Drive interface

The drive interface is used to connect NC axes to the controller via various drive types.

2.2 Commanding and execution

Homing is commanded either for “Homing ” mode or by the NC command **G74** for specific channels. This command can be executed either in a manual block or in an NC program.

When referencing, the axis adopts the reference position P-AXIS-00152 (pos_refpkt) from the axis parameter list and stops.

NC program

Homing is started either:

- **implicitly** in homing mode with the default homing program rfp.nc or
- **explicitly** with any NC program that started in ‘Automatic’ mode or with a manual block which is executed in MDI mode.

Homing sequence of axes

The NC command G74 specifies the axes to be referenced and the sequence in which the axes are to execute homing. A

- **sequential** and a
- **parallel** command of the axes are possible.

The values programmed with the axis names define the homing sequence. For axes with the same value, homing is triggered simultaneously (see also [PROG]).

Sequential commanding

In the example below, axes Z, X, Y, A and B are commanded sequentially, i.e. Z is referenced before X starts homing, etc.

```
…
N10 G74 Z1 X2 Y3 A4 B5
…
```

This mode may be required, for example, to move the Z tool axis out of a collision zone with the workpiece or other axes. The other axes are then referenced.

Parallel commanding

In the example below, homing is executed in parallel (simultaneously) for the axes X, Y A and B.

```
…
N10 G74 X1 Y1 A1 B1
…
```

This mode is ideal due to the shorter time required at low homing speeds and the large motion range of the axis.

Another reason may be kinematic axis couplings which do not permit sequential homing.

NC program for referencing

In the example below, the Z axis is first referenced and moved to safety height. In the next NC block, the axes X and Y are then commanded in parallel and afterwards the axes A and B are also commanded in parallel. Finally, spindle S is referenced.

```
%RPF.NC
N10 G74 Z1
(optional: move Z to safety height)
N15 G01 G90 Z200 F500
N20 G74 X1 Y1 A2 B2 S3
…
(optional: move axes to home position)
N30 G01 X0 Y20 Z0 A90 F1000
N40 SPOS0 S500
...
N40 M30
```

After homing is completed, the axes can be positioned by a motion command to any position within the software limit switch. It is also possible to execute any initialisation here.

Drive-controlled referencing

Drive-controlled referencing describes homing which is executed independently by the drive. The NC controller commands the drive to reference its axis and at the end of homing it receive confirmation from the drive whether reference was executed successfully.

Homing is only parameterised in the drive.

The CNC support drive-controlled referencing by drives with SERCOS interface.

Except for P-AXIS-00014 all homing parameters in the axis parameter list only apply to NC-controlled referencing.

NC-controlled referencing

With NC-controlled referencing the entire homing sequence is determined by the NC controller. Homing can be parameterised for each axis using the homing parameters in the axis parameter list. Depending on the homing strategy selected, the reference cam signal may have to be provided on the HLI.

Supported drive types

NC-controlled referencing is supported for the following drive types:

- Drive simulation (by digital filters)
- Profidrive
- Terminal (+/-10V drives with incremental encoders, transparent access via field buses)
- Lightbus
- Real-time Ethernet

At present, NC-controlled referencing is only supported for drives with SERCOS interface without zero pulse search.

Drive simulation

The NC controller supports the “Simulation” drive type, i.e. every axis can be simulated, for example if there is no physical drive (±10V, stepper motor, etc.) present at the time of machine commissioning or if the controller is to be tested completely without physical drives.

Homing can also be selected for this drive type. Referencing these axes is simulated and this can be set in the axis parameter list by corresponding parameters.

Gantry coupling

With a gantry coupling, the parameter P-AXIS-00074 can suppress homing of the gantry slave axis. The reference position is then adopted by the gantry master axis on completion of homing and monitoring the gantry difference between the master and slave axes can be started.

In another case, homing can also be executed for gantry slave axes after the master axis is referenced. In both cases, the other mechanically coupled axis is tracked.

2.3 Sequence strategies for homing

The homing sequence of a machine axis is dependent on various factors, e.g.:

- Is a reference cam present?
- Is a zero pulse signal triggered?
- Should the reference cam be approached with cam clearance?

The various sequence strategies for homing are divided into the following methods and then described in greater detail:

- Default homing
- Flying homing for spindles
- Special homing methods

Default homing

For the default homing, it is assumed that a reference cam switch is present and the position counter can be latched by a cam or zero pulse signal.

The chronological sequence of default homing normally occurs in 3 phases:

- Phase 1: Move to reference cam
- Phase 2: Move away from reference cam
- Phase 3: Move to reference cam with referencing

The 3-phase default homing has 2 changes of direction. The motions can be parameterised at 2 different velocities.

Individual phases can be skipped with variants of this homing. Homing can then be reduced to a single phase. In this case, no change of direction is executed.

Flying homing for spindle axes

Flying homing is only available for spindle axes. The spindle axis must be referenced in order to set up a spindle axis, i.e. position with M19.

If the spindle axis is not referenced or if the reference point was lost, the spindle axis executes homing automatically. Flying homing is executed while the spindle axis is rotating without standstill.

Special homing methods

In special cases, default homing cannot be executed. The special homing methods below list further options to reference an axis according to the related parameterisation.

- Referencing with motion away from cam
- Referencing without reversal
- Referencing only with zero pulse without reference cam
- Referencing in the direction of the valid motion range by reversing the reference direction and reversing the cam signal level
- Referencing by motion to fixed stop

2.3.1 Default homing

Default homing is the most commonly used method in practice to reference machine axes.

Condition

- Default homing requires the presence of a reference cam.
- Default homing executes the cam clearance of the machine axis.
- In general, a counter hardware with latch input is required to achieve high referencing accuracy.

Parameterisation	P-AXIS-00156 (ref_ohne_nocken)	0 , with reference cam
	P-AXIS-00157 (ref_ohne_rev)	0 , with cam clearance

Chronological sequence

The chronological sequence of default homing normally occurs in 3 phases:

- Phase 1: Move to reference cam
- Phase 2: Move away from reference cam
- Phase 3: Move to reference cam with referencing

The figures below show the sequence of default homing.

Zero pulse

When referencing with zero pulse and with the required hardware support, the zero pulse results in the immediate latching of the counter value provided the strobe input was previously activated. In this way, the motion velocity has no influence on referencing accuracy when referencing is executed with zero pulse evaluation.

A zero pulse is not necessarily required for default homing. The zero pulse is evaluated in Phase 3 during the referencing process when the reference cam switch is operated.

Referencing only with reference cam without zero pulse reduces referencing accuracy depending on the motion velocity. Referencing without zero pulse is depicted in Figure 2-3.

The following velocity-path diagrams show in simplified form the acceleration and deceleration phases as linear straight lines.

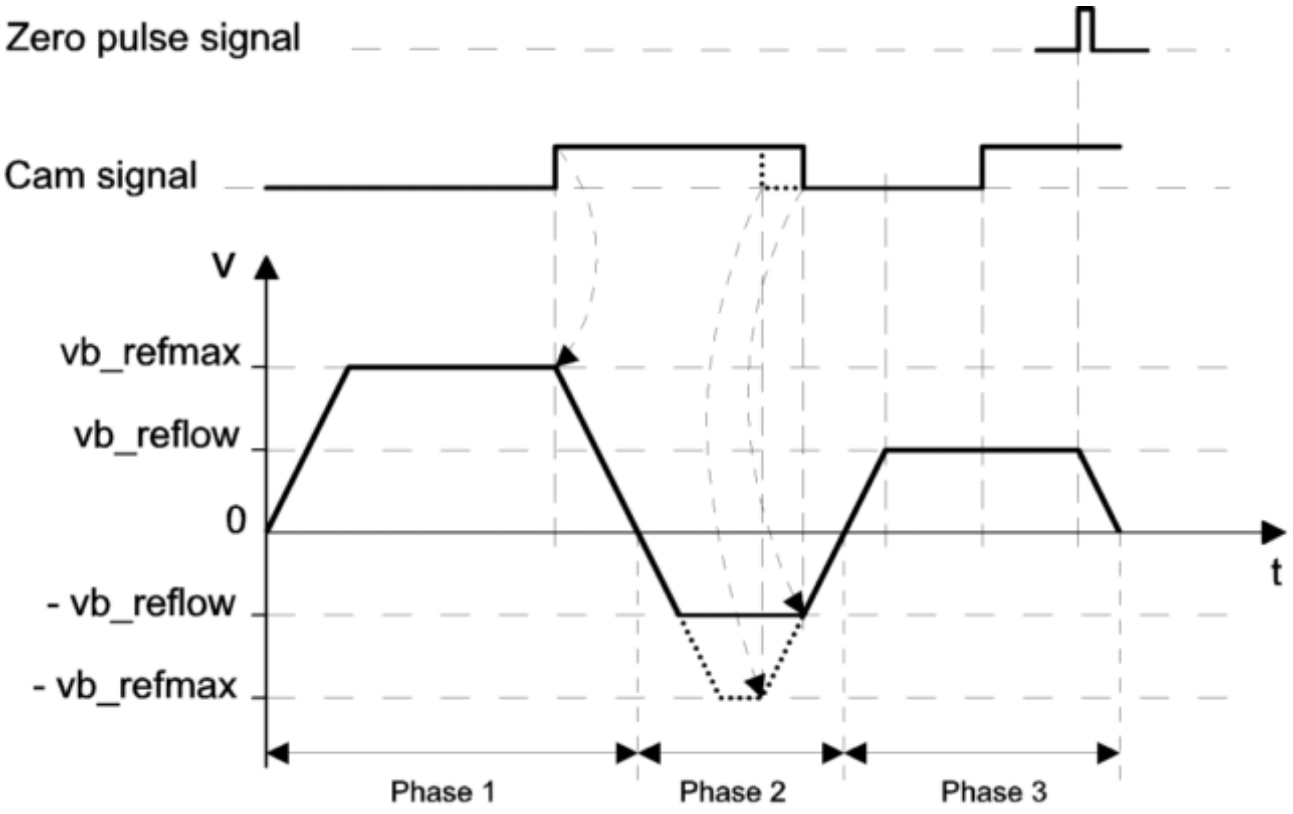

Fig. 3: Default homing in time range

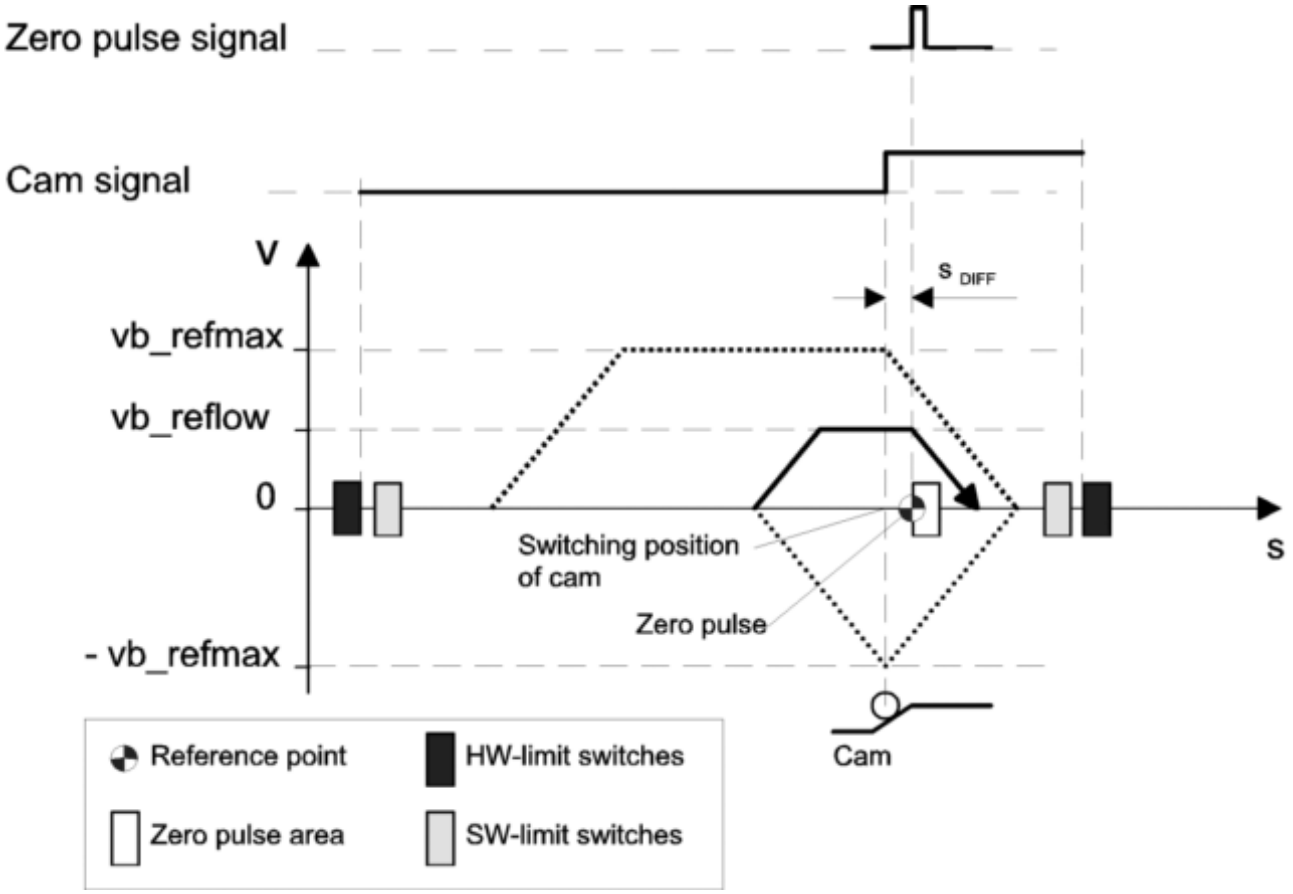

Fig. 4: Default homing

2.3.1.1 Phase 1: Move to reference cam

Parameterising Phase 1	P-AXIS-00158 (ref_richt)	Referencing direction
	P-AXIS-00219 (vb_refmax)	Fast referencing velocity

Start of Phase 1

Homing is started by the NC command G74 or by starting the 'Homing' mode. The machine axis is at standstill and homing is in preparation.

The starting point for Phase 1 can be 2 situations:

- Axis located in front of cam
- Axis located on cam

Axis located in front of cam

The machine axis accelerates to fast referencing velocity P-AXIS-00219 (vb_refmax) in the referencing direction P-AXIS-00158 (ref_richt). The CNC controller is notified via the HLI interface when the reference cam is reached and the machine axis is then decelerated to standstill.

Phase 1 is terminated and the process continues with Phase 2.

Axis located on cam

If the reference cam is already operated when homing starts, Phase 1 is not executed. The machine axis remains at its starting position.

Phase 1 is terminated and the process continues with Phase 2.

2.3.1.2 Phase 2: Move away from reference cam

Parameterising Phase 2	P-AXIS-00064 (fast_from_cam)	Slow or fast motion away from reference cam.
	P-AXIS-00158 (ref_richt)	Referencing direction
	P-AXIS-00219 (vb_refmax)	Fast referencing velocity
	P-AXIS-00218 (vb_reflow)	Slow referencing velocity

Start of Phase 2

Phase 2 is started automatically if Phase 1 was completed successfully and the machine axis is located on the reference cam.

Execute Phase 2

The machine axis accelerates to the parameterised reference velocity and moves in the opposite reference direction P-AXIS-00158 (ref_richt) away from the reference cam. The CNC controller is notified of the machine axis when it leaves the reference cam. The machine axis is then decelerated to standstill. The parameter P-AXIS-00064 (fast_from_cam) defines whether the referencing velocity is slow or fast in Phase 2.

Phase 2 is terminated and the process continues with Phase 3.

2.3.1.3 Phase 3: Move to reference cam with referencing

Parameterising Phase 3	P-AXIS-00084 (homing_without_zero_pulse)	With or without zero pulse
	P-AXIS-00158 (ref_richt)	Referencing direction
	P-AXIS-00218 (vb_reflow)	Slow referencing velocity, e.g. 15000 [µm/s]

Start of Phase 3

Phase 3 is started automatically if Phase 2 was completed successfully and the machine axis is no longer located on the reference cam.

The reference position can be searched by:

- the zero pulse or
- the reference cam.

Referencing with zero pulse

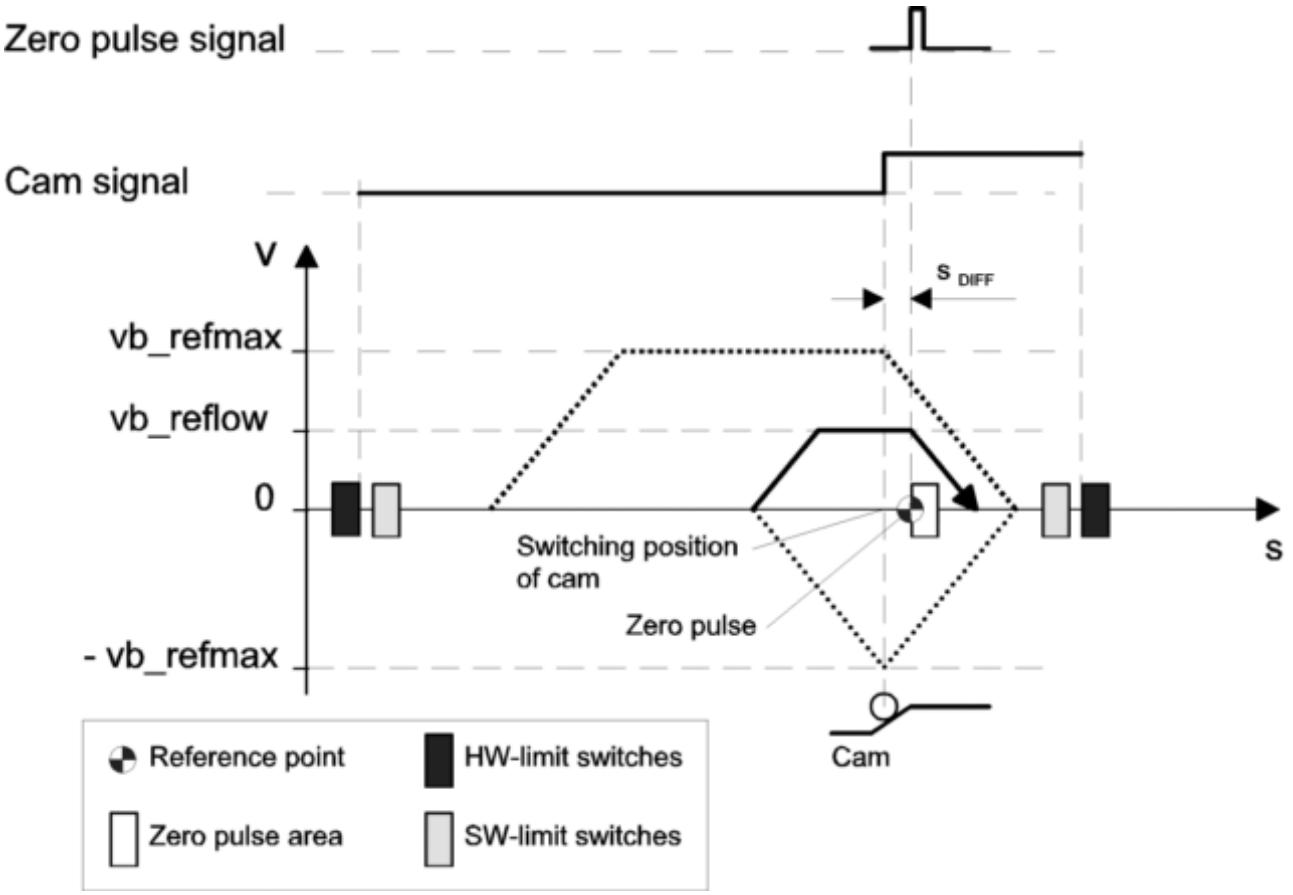

Fig. 5: Homing in 3 phases, referencing to the reference cam with zero pulse

Referencing with reference cam

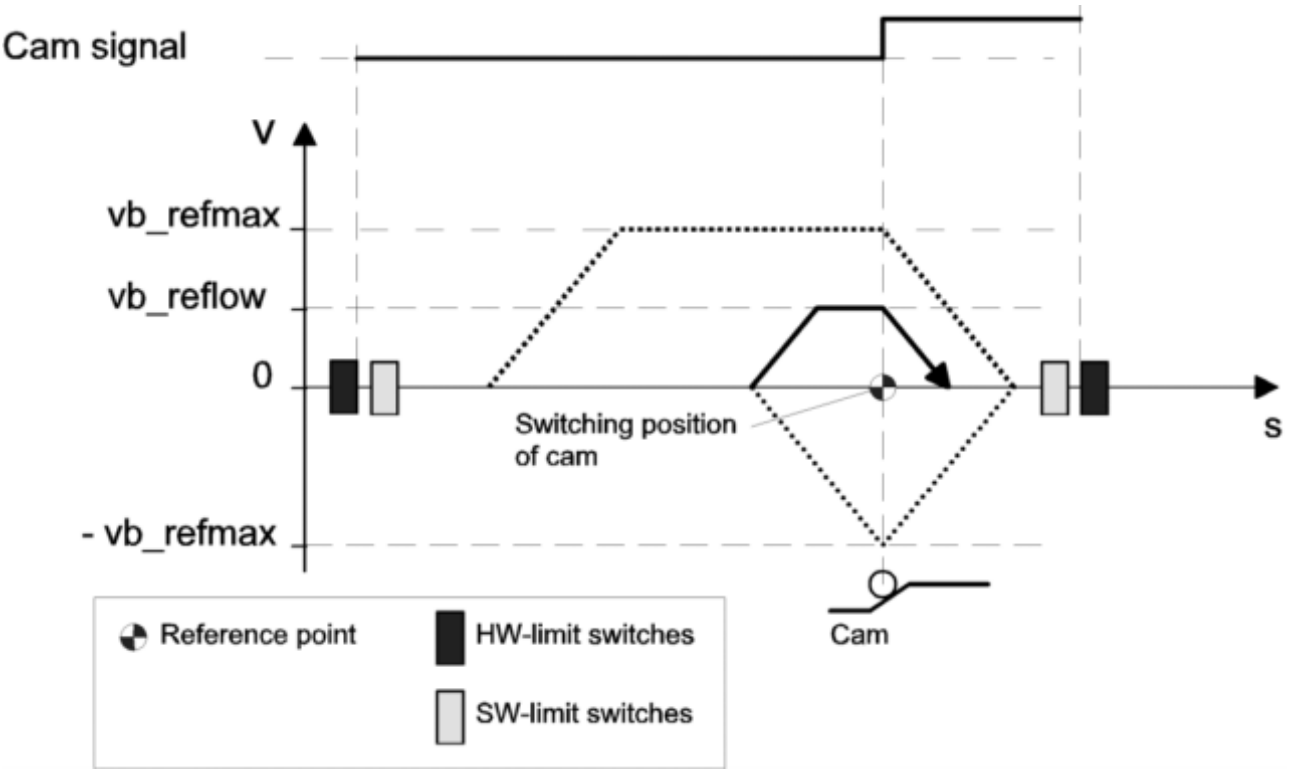

Fig. 6: Homing in 3 phases, referencing to the reference cam with zero pulse

With this parameterisation, reference is executed on the positive edge of the cam signal in Phase 3, i.e. during motion to the cam.

Referencing is executed when the cam switch is operated in the Phase 3 of the homing sequence. With this method, the referencing accuracy is defined by the axis velocity (vb_reflow) in Phase 3 and the sampling time since the position is only adopted at discrete times and the position value is not latched as with zero pulse evaluation.

This method is used in stepper motor applications without incremental encoder, for example. A generally acceptable accuracy is attainable here if P-AXIS-00218 (vb_reflow) is initialised so that the motor moves at one increment per sampling cycle in the 3rd phase.

This method is also used for “separable” drives (toothed rack, pinion) where the zero pulse signal is not normally used.

2.3.2 Flying homing for spindle axes

Description

The parameters P-AXIS-00157 (ref_ohne_rev) and P-AXIS-00156 (ref_ohne_ nocken) are used to define the homing strategy.

- "ref_ohne_rev" defines whether the axis should have a cam clearance.
- "ref_ohne_nocken" defines whether only the zero pulse signal is evaluated for homing or whether the cam signal is also evaluated.

Conventional homing is executed if both "ref_ohne_rev" and "ref_ohne_nocken" are set to FALSE.

The combination of setting "ref_ohne_rev" to FALSE and "ref_ohne_nocken" to TRUE is impractical since cam signal evaluation is required for cam clearance.

The variable "ref_ohne_rev" must be set to TRUE to execute flying homing from endless rotation without reversal. The table below shows the settings for the various RFP (homing) types.

ref_ohne_rev = FALSE	**ref_ohne_rev = TRUE**	
ref_ohne_nocken = FALSE	conventional homing	flying homing with cam
ref_ohne_nocken = TRUE	impermissible setting	flying homing without cam

With conventional axes and simulation axes, the position controller is enabled automatically for homing if homing was previously disabled.

A specific homing position exists for each gear speed and this is specified in the axis machine record.

In general, the CNC automatically executes homing before setting up the spindle axis (M19, move to gear change position or axis position) if the reference point is not valid (any more). For example, if the maximum encoder frequency is exceeded by a speed that is too high. However, from endless rotation this can only be executed if the parameter "ref_ohne_rev" is set to TRUE. Otherwise, an error message is output and a transition takes place to error state.

When SERCOS drives are referenced drive-controlled, the automatic RPF mechanism must be suppressed. In this case, set the ACHSMODE_KEINE_AUTO_RPF bit to axis mode (P-AXIS-00015) in the axis machine record.

2.3.2.1 Homing without reversal

Homing without reversal

With homing without reversal and when the spindle is at standstill, the motion accelerates to the speed P-AXIS-00218 (vb_reflow) in the axis machine record. The spindle is accelerated not to the current limit but with default ramps. The rotation direction is initialised with the homing direction P-AXIS-00158 (ref_richt). When the spindle machine data is initialised, a check is made whether a preferred direction is specified for the spindle. If this does not match the specified homing direction, an error message is output.

If the spindle executes homing from endless rotation, it first accelerates or decelerates to the homing speed “vb_reflow” before being references. The referencing direction is identical to the endless rotation direction.

The spindle is set up with programmed speed and rapid traverse speed after homing without motion stop. This means that **flying homing** takes place. Positioning takes ´place in the direction in which homing was executed, even if this does not match the specified rotation direction.

Homing without spindle reversal can basically be executed in two methods. The method is defined by the value (TRUE/FALSE) of the variable P-AXIS-00156 (ref_ohne_nocken) in the axis machine record.

Parameterisation ref_ohne_nocken 0

Read cam and zero pulse

This is used to trigger both the reference point cam and the zero pulse.

The reference point cam is triggered at the point when the ‘not operated’ edge changes. This means that, if the cam is currently operated, the spindle is rotated until the cam is not operated.

Parameterisation ref_ohne_nocken 1

Only the zero pulse is used for triggering. This method can be used if only one zero pulse is triggered per spindle rotation.

Spindle modes (not SERCOS)

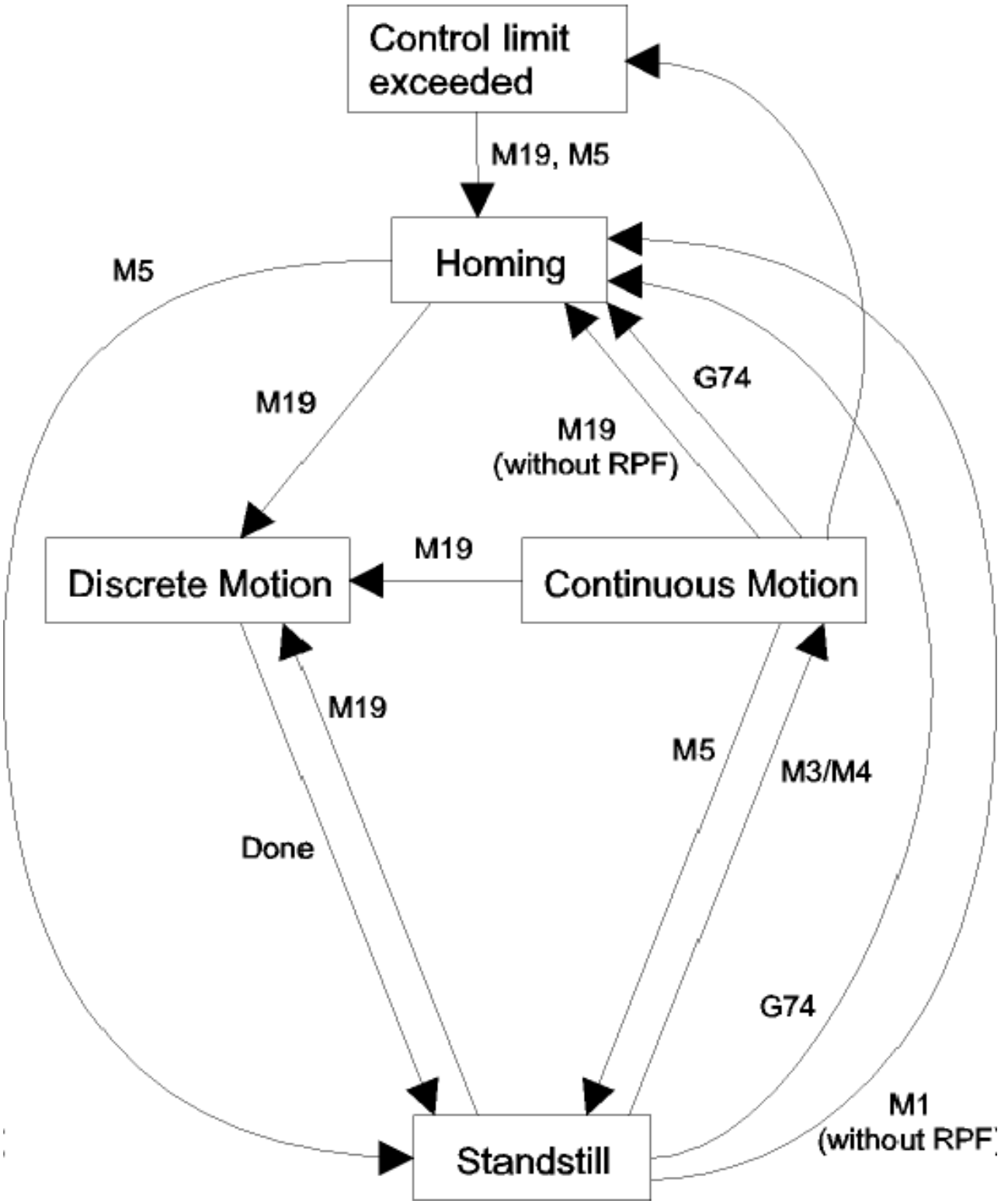

Fig. 7: State graph of spindle modes

Homing with SERCOS drives

Drive-controlled homing is used for SERCOS drives. This means that the ACHSMODE_KEINE_AUTO_RPF bit must be set in the parameter “achs_mode” in the axis machine record for the spindles to prevent automatic referencing. The parameters “ref_ohne_rev” and “ref_ohne_nocken” are then no longer evaluated.

Before it is set up, a spindle with SERCOS drive must be subjected to explicit homing (via the automatic program or via a manual block). Otherwise an error message is output.

Spindle modes with SERCOS

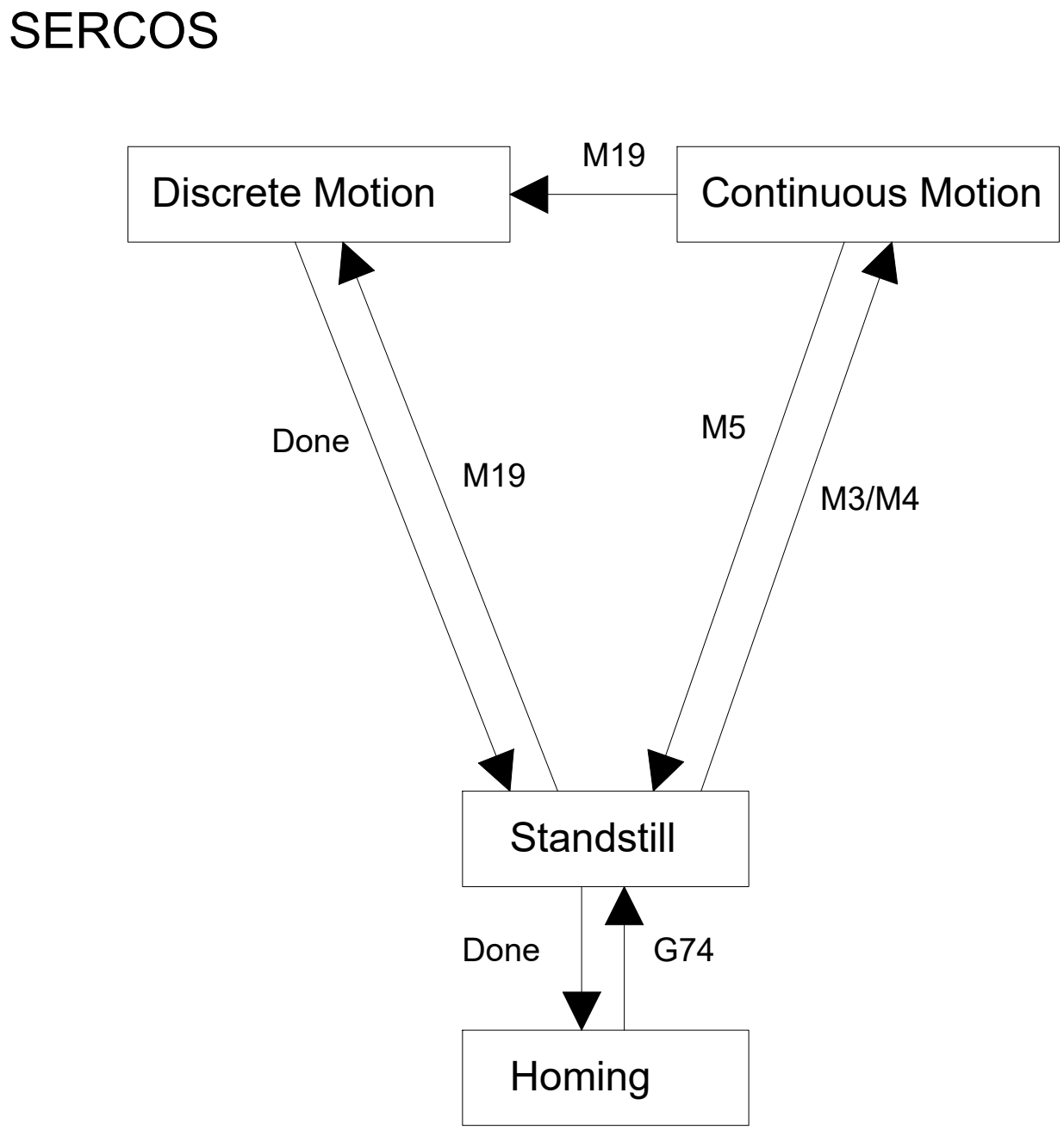

Fig. 8: State graph of spindle modes for digital drives (e.g. SERCOS)

2.3.3 Special homing methods

In special cases, default homing cannot be applied. The special homing methods below list further options to reference an axis according to the related parameterisation.

- Referencing with motion away from cam
- Referencing without reversal
- Referencing only with zero pulse without reference cam
- Referencing in the direction of the valid motion range by reversing the reference direction and reversing the cam signal level
- Referencing by motion to fixed stop

2.3.3.1 Referencing with motion away from cam

Referencing takes place on the falling edge using a simple method, i.e. by inverting the motion direction during referencing (ref_richt) and the cam switch signal level (cam_level). Providing the cam switch is operated at the start of homing, this is then a 3-phase homing.

This method has advantages if the reference position is outside the corresponding software limit switch in the method described above. The following changes result for the above example:

Parameterisation	P-AXIS-00038 (cam_level)	0
	P-AXIS-00158 (ref_richt)	0

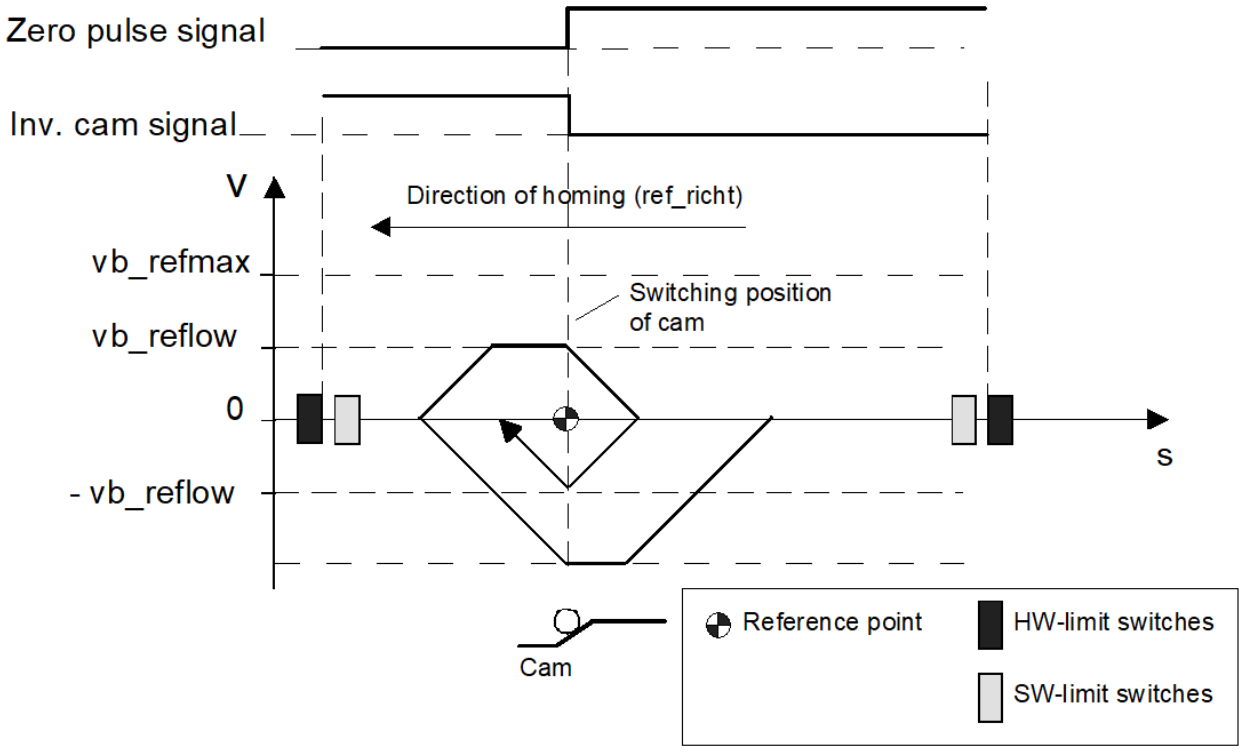

Fig. 9: Referencing at motion away from reference cam (without zero pulse)

2.3.3.2 Homing without reversal

Referencing in 1 phase

Referencing in one phase is executed without change in direction

Examples for translatory axes

NOTICE

Referencing in one phase is optional but should not be used in reality. Please note here that the axis many not be located on the reference cam at the start of homing.

This check is executed by the PLC.

Parameterisation	P-AXIS-00156 (ref_ohne_nocken)	0, reference cam present
	P-AXIS-00084 (homing_without_zero_pulse)	0, with zero pulse
	P-AXIS-00157 (ref_ohne_rev)	1, no reversal

Referencing with zero pulse

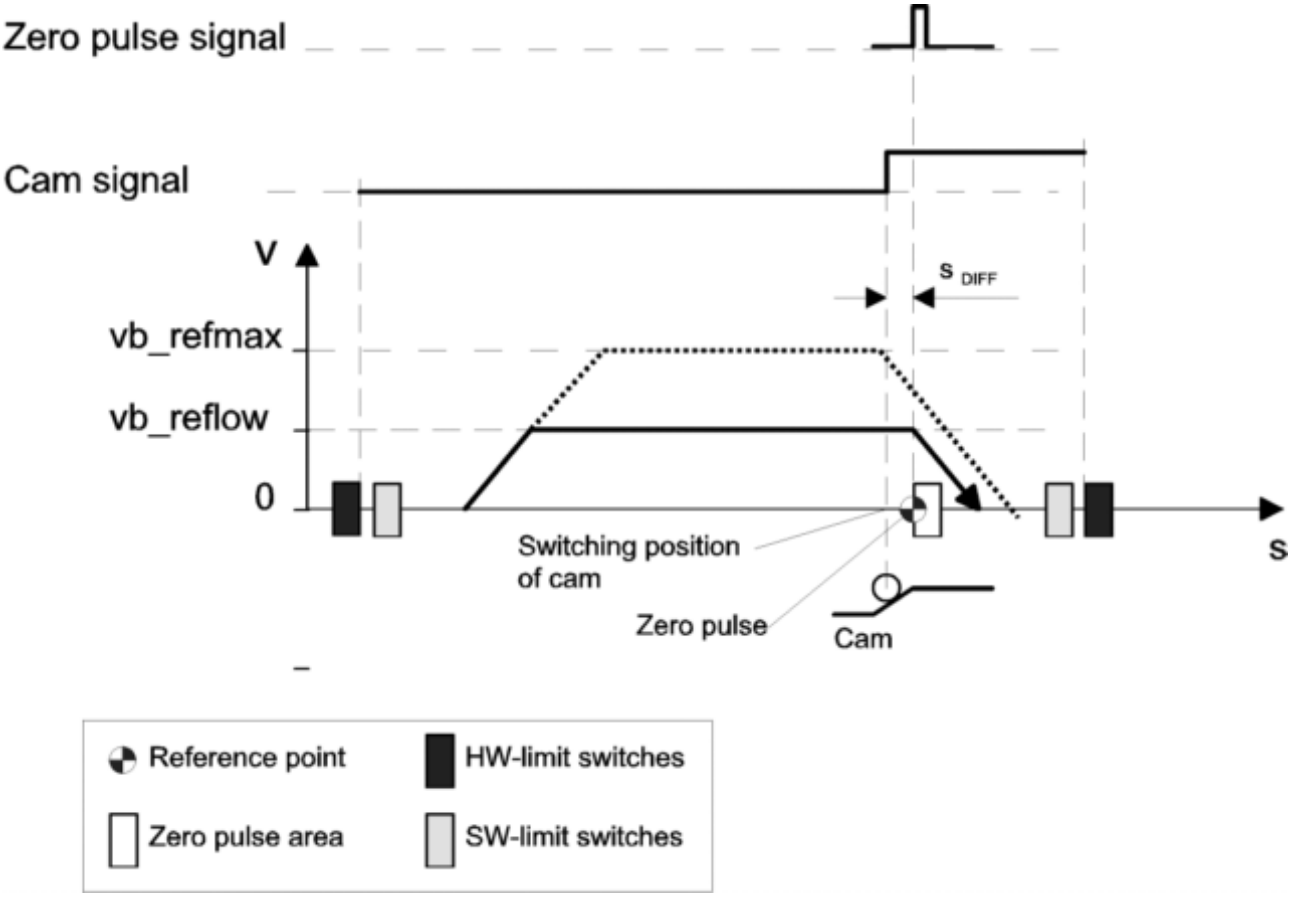

Fig. 10: Move to reference cam with zero pulse (1 phase)

Referencing without zero pulse

Parameterisation	P-AXIS-00156 (ref_ohne_nocken)	0, reference cam present
	P-AXIS-00084 (homing_without_zero_pulse)	1, no zero pulse
	P-AXIS-00157 (ref_ohne_rev)	1, no reversal

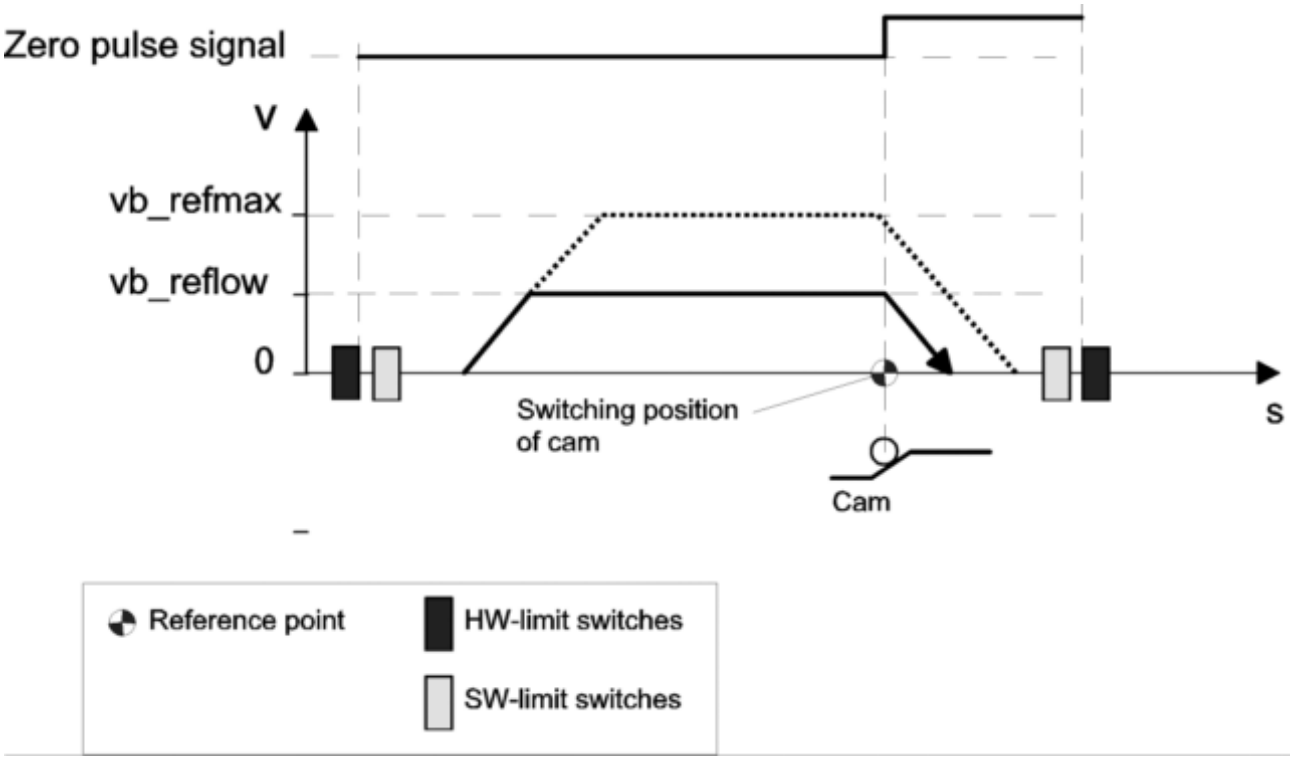

Fig. 11: Move to reference cam without zero pulse (1 phase)

2.3.3.3 Referencing with zero pulse without reference cam

Parameterisation	P-AXIS-00084 (homing_without_zero_pulse)	0, with zero pulse
	P-AXIS-00156 (ref_ohne_nocken)	1 , without reference cam
	P-AXIS-00157 (ref_ohne_rev)	1, no reversal
	P-AXIS-00158 (ref_richt)	Referencing direction
	P-AXIS-00218 (vb_reflow)	slow referencing velocity

Process

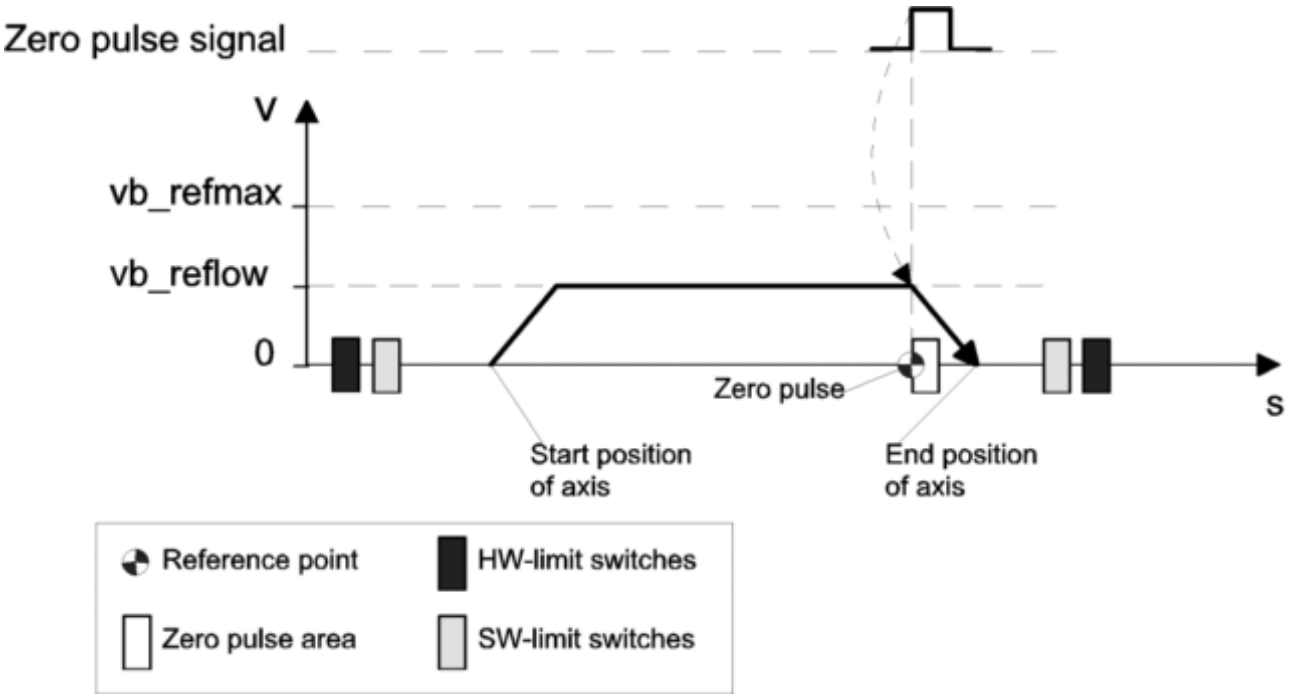

Fig. 12: Referencing with zero pulse without reference point cam

2.3.3.4 Referencing by motion to fixed stop, NC-controlled

In order to use this referencing method, the axis parameter P-AXIS-00299 (kenngr.homing.homing_type) must be parameterised with the value **TORQ**.

This referencing method is implemented for the following drive interfaces (see P-AXIS-00020):

Value	Meaning
0x0004	Drive simulation
0x0009	Generic drive interface

Other general parameters must be assigned values to define how homing is to run with motion to a fixed stop. They are In the axis list, they are indicated by the prefix kenngr.homing. prefix; see table:

General parameters for referencing to fixed stop

Name	Dimension	Value range	Description
torq_min_distance (P-AXIS-00344)	0.1 µm	< torq_max_distance	Minimum distance up to detection of the reference position

torq_max_distance (P-AXIS-00345)	0.1 µm	0 ... MAX_SGN23	Maximum distance up to detection of the reference position
torq_homing_dir (P-AXIS-00346)		[POSITIVE, NEGATIVE]	Direction of reference point travel
torq_detect_velocity_limit (P-AXIS-00347)	0.1%	0 ... 1000	Speed limit for detection of the reference position
torq_retraction_distance (P-AXIS-00348)	0.1 µm	MAX_SGN32	Withdrawal distance after detection of the reference position
torq_homing_position (P-AXIS-00349)	0.1 µm	MAX_SGN32	Reference position
torq_detect_time (P-AXIS-00350)	µs	MAX_UNS32	Minimum time that the limit torque must be exceeded for the reference position to be detected.

The parameters that are dependent on the gear stage are indicated by the prefix **getriebe[X].homing**. In this case, an ordinal number must be entered for **X** for each gear stage; see table:

Gear stage-specific parameters for referencing to fixed stop

Name	Dimension	Value range	Description
torq_move_acceleration (P-AXIS-00334)	mm/s^2	<= a_max	Acceleration
torq_move_velocity (P-AXIS-00333)	µm/s	<= vb_max	Velocity for axis motion
torq_move_torque_limit (P-AXIS-00342)	0.1%	0 ... 1000	Percentage torque limit for motion
torq_detect_torque_limit (P-AXIS-00343)	0.1%	0 ... 1000	Limit for detection of the standing axis. Percentage value referred to torq_move_torque_limit.

The graphic below shows the way in which the parameters listed have an influence on motion to a fixed stop.

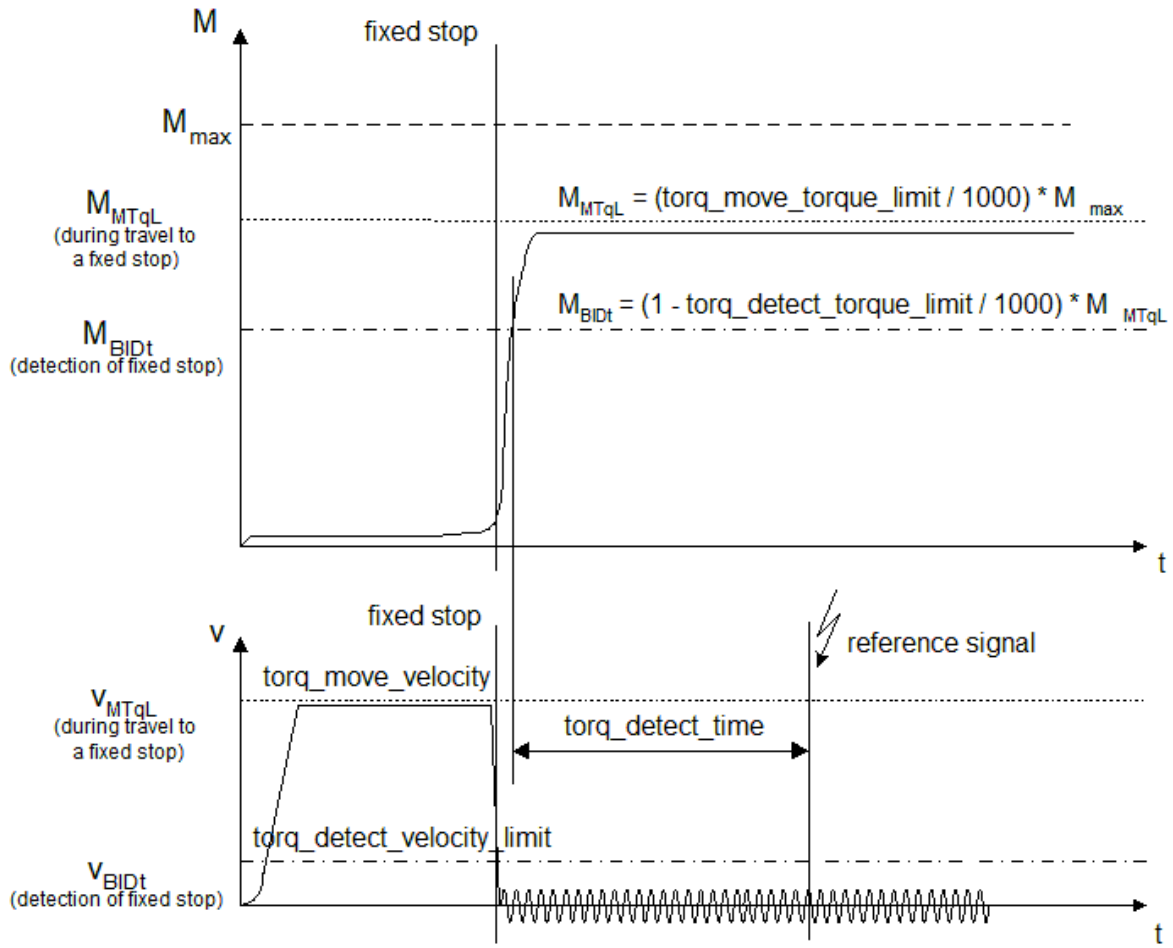

Fig. 13: Influence of parameters during motion to a fixed stop

2.4 Monitoring after homing

2.4.1 Path monitoring

The parameter P-AXIS-00412 can execute path monitoring for spindles and rotary axes.

This checks whether the reference position was found within a distance from the homing start position. This distance is parameterisable by P-AXIS-00412. What is meant here is whether the reference cam and/or the zero pulse was found, for example.

2.5 Monitoring after homing

2.5.1 Reference loss (reference monitoring)

Reference monitoring is currently possible only for the SERCOS drive type (see P-AXIS-00020). For all other drive types, the error message P-ERR-110548 is output when reference monitoring is activated.

Motivation

In most cases it is desirable to check whether an axis that was referenced once has lost its reference.

For example, when absolute encoders are used that store internal working data in a memory with battery backup, it may happen after a few years that the backup battery is exhausted and the absolute encoder supplies an incorrect position.

Equally, when drive amplifiers are parameterised and decisive parameters are changed, it can happen that an already referenced axis loses its reference again.

In both cases, this leads to an unexpected shift in the position supplied by the drive relative to the mechanical position of the axis. This may result in damage to the machine.

To prevent this, an option was devised to check whether an axis has lost its reference.

Operating principle

In reference monitoring, a signal generated in the drive controller indicates whether the axis is referenced. The signal is transferred via the cyclic process data to the CNC. There a check is made whether the expected state of this signal is correct. This 'axis is referenced' signal is referred to below as the reference signal.

For example, for an absolute value encoder, the axis is referenced immediately after the start of cyclic data transfer.

For an axis without absolute value encoder, the axis is referenced as soon as drive-controlled homing is completed successfully.

The CNC controller has the possibility to compare the reference signal supplied by the drive with the internally calculated expected reference signal and to output an error message in the event of deviations.

Parameterisation

The parameterisation basically defines transfer of the reference signal from the drive to the CNC.

The name of the cyclic process data item that transfers the reference signal must then be specified in the axis parameter P-AXIS-00426.

If the reference signal is transferred in one of the real-time status bits of the SERCOS status word, the value "S-0-0135" must be entered in P-AXIS-00426. The signal status word need not be explicitly configured in the input process data because it is always configured automatically.

If the name configured in P-AXIS-00426 is not found in the cyclic input process data, the error message P-ERR-70401 is output and reference monitoring is deactivated.

Activation/effect

Reference checking is activated as soon as valid values are configured for the axis parameters P-AXIS-00425 and P-AXIS-00426.

When reference checking is active, the error message P-ERR-70400 is output as soon as the CNC detects a discrepancy between the reference signal supplied by the drive and the CNC-internal reference signal.

Parameterisation example 1

A reference check is to be executed for a SERCOS drive. The reference signal should be transferred via the real-time status bit 1.

Parameterisation in the drive:

The reference signal must be assigned to the real-time control bit 1 in the drive. This takes place by assigned the value S-0-403 (status of actual value position) to the drive parameter S-0-305 (assign real-time status bit 1).

Axis parameters:

Since the reference signal is read from the real-time status bit of the status word, the value "S-0-0135" must be entered in P-AXIS-00426.

The real-time status bit 1 in the status word is the bit with the number 6 (counted from 0) and so the value 6 must be entered in P-AXIS-00425.

```
antr.homing_check.element_name        S-0-0135
antr.homing_check.bit_nr              6
```

Parameterisation example 2

A reference check is to be executed for a SERCOS drive. The reference signal should be transferred via bit 2 of the drive parameter P-0-4078.

Parameterisation in the drive:

The parameter P-0-4078 must be configured in the cyclic process data of the drive.

Axis parameters:

Since the reference signal is read from P-0-4078, the value "P-0-4078" must be entered in P-AXIS-00426.

The reference signal in P-0-4078 is the bit with the number 2 (counted from 0) and so the value 2 must be entered in P-AXIS-00425

```
antr.sercos.at[1].ident_nr          36846
antr.sercos.at[1].ident_len         2
antr.sercos.at[1].nc_ref            P-0-4078

antr.homing_check.element_name      P-0-4078
antr.homing_check.bit_nr            2
```

2.6 Delayed activation of zero pulse logic

Activation

A path offset can be specified in the parameter “kenngr.shift_offset_zero_pulse_activation“ P-AXIS-00494 for CNC-controlled homing (see P-AXIS-00299) in order to delay activation of the zero pulse logic after the reference cam is operated.

This parameter is 0 in the default setting. The zero pulse logic is immediately enabled when the reference cam is operated.

Operating principle

If the reference cam and zero pulse are located close together, the zero pulse may not be detected reliably since detection of the next or the next but one zero pulse depends on the activation speed of the reference cam. See figure below:

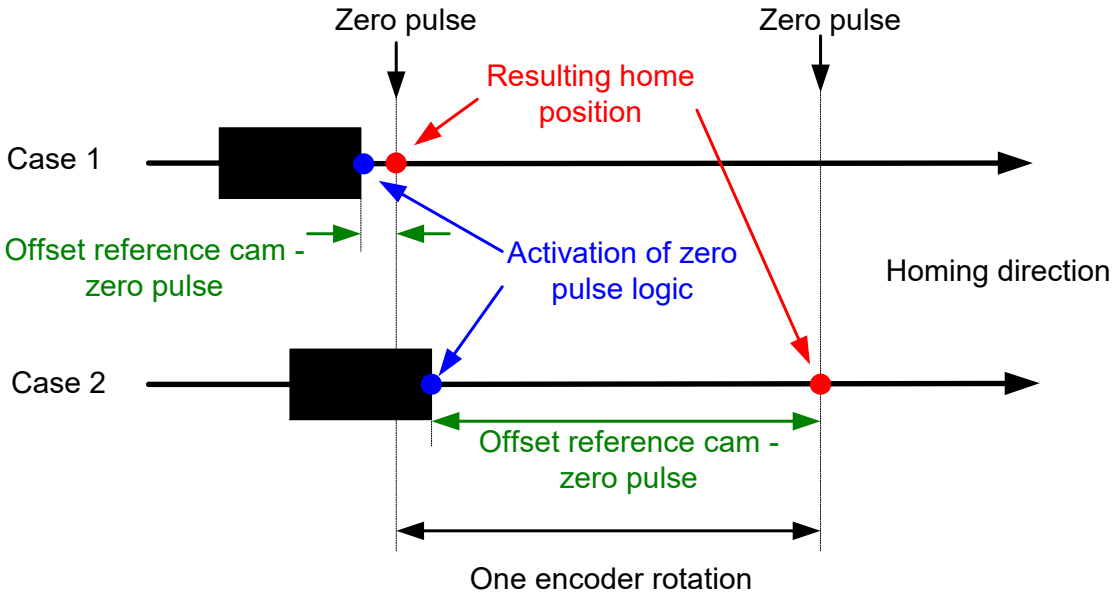

Fig. 14: The zero pulse may not be reliably detected

In this case a shift of the activation point for the zero pulse logic ensures that the identical zero pulse is always detected:

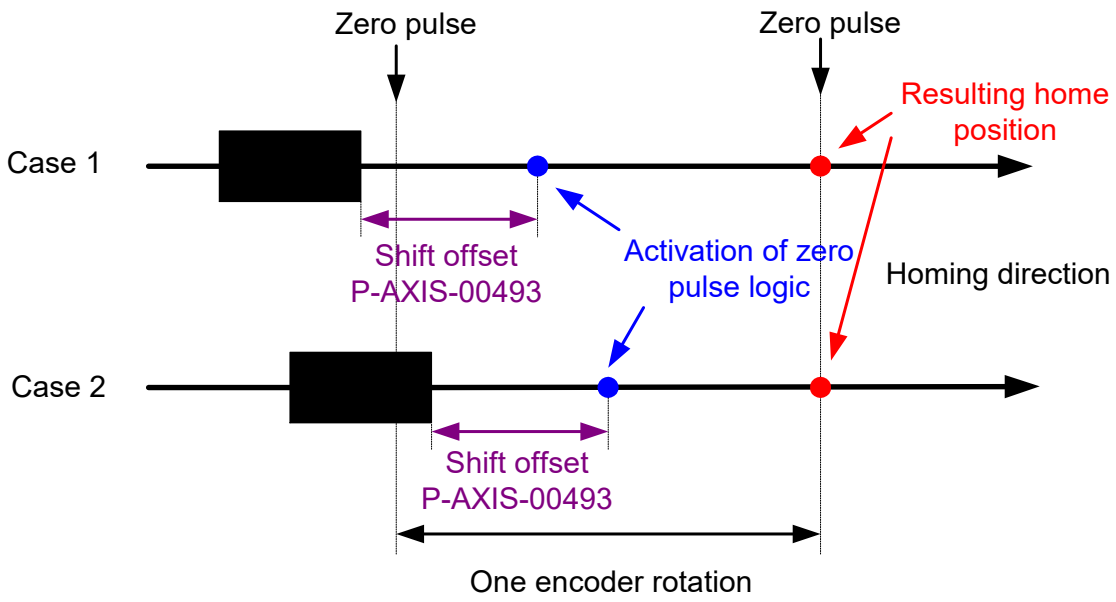

Fig. 15: Activation time shift of zero pulse logic ensures identical zero pulse

After homing, the position offset between the activation of the reference cam and detection of the zero pulse can be read out via the CNC object “reference cam - zero pulse offset”:

- Geo task,
- index group: 0x20300/
- index offset: 0x10000 * (axis_index + 1) + 0x11C

Examples 1. axis -> index offset 0x1011C
3rd axis -> index offset 0x3011C,

3 Parameterisation

Homing is parameterised axis-specific in the axis parameter list of an axis. This is divided depending on its task into:

- system parameters and
- sequence parameters

System parameters

System parameters are used to make machine-specific settings in the drive system. The controller is notified of the information below in these parameters:

- Is the axis equipped with reference cams?
- Is zero pulse or cam signal used for referencing?
- What signal level does the cam supply in operated state?

Sequence parameters

The sequence parameters define the response during homing. This includes, for example:

- The velocity at which motion takes place in each of the homing phases.
- The motion direction in which homing is started or executed.
- The number of phases (single-phase or multi-phase) up to referencing.

Effectiveness of parameters

The section "Effectiveness of parameters" [▶ 47] provides an overview of the effectiveness of homing parameters depending on the homing strategy used.

3.1 System parameters

3.1.1 Drive types

The parameter P-AXIS-00020 sets the axis drive type. With certain drive types, e.g. Simulation, very few homing-specific parameters are significant.

P-AXIS-00020 (antr_typ)

1. +/-10V drives with incremental encoders using a function library for I/O access (option)
2. SERCOS
3. Profidrive
4. Drive simulation (by digital filters)
5. Lightbus
6. Terminal (+/-10V drives with incremental encoders, transparent access via field buses)
7. Real-time Ethernet

3.1.1.1 Simulation axis

Homing simulation

For spindle axes, the variable P-AXIS-00157 (ref_ohne_rev) must then be set to TRUE in the axis machine record.

Homing in drive simulation is executed automatically without cam. The homing sequence is identical to the sequence for conventional drives.

The distance until the zero pulse is received must be set in the variable P-AXIS-00161 (rpf_weg_bis_nip) in the axis machine record.

3.1.1.2 SERCOS axis

Homing for SERCOS

SERCOS axes can be reference with the following methods:

(The homing type executed is defined in the axis parameter P-AXIS-00299 (homing_type).)

- Drive-controlled (default)
  In this case, only P-AXIS-00014 (abs_pos_gueltig) and P-AXIS-00015 (achs_mode) need be parameterised as CNC parameters. The homing sequence must be set in the drive
- CNC-controlled with zero pulse latch.
- CNC-controlled with zero pulse latch via probing input
- CNC-controlled at encoder overflow.

Drive-controlled homing

Drive-controlled homing is the default setting for SERCOS axes.

In drive-controlled homing, the CNC starts the SERCOS command S-0-148 in the drive and waits for the drive to acknowledge it. After acknowledgement, the CNC adopts the drive command values as CNC-internal command values.

The homing sequence and the drive reference position are completely parameterised in the drive.

The reference cam must be connected to the drive.

This homing type is set by assigning the value ‘DRIVE_CONTROLLED’ to the axis parameter P-AXIS-00299 (homing_type).

No drive-controlled homing is possible for SERCOS axes whose position control is executed in the controller.

CNC-controlled with zero pulse latch via S-0-146

With CNC-controlled homing, all the sequence variants described in the section Sequence strategies for homing [▶ 17] are available.

The zero pulse search is performed by executing the SERCOS command S-0-146 in the drive. After the zero pulse is detected in the drive, the actual position is switched over to the reference position in the drive and the CNC adopts this position.

The reference position is set by the axis parameter P-AXIS-00152 (pos_refpkt). This value is transferred to the drive at the start of homing

This homing type is set by assigning the value ‘CNC_CONTROLLED’ to the axis parameter P-AXIS-00299 (homing_type).

The value 0 must be assigned to the axis parameter P-AXIS-00299) (homing_without_zero_pulse); the parameter P-AXIS-00386 (drive_supports_cnc_homing) activates use of the drive-internal zero pulse latch.

For the zero pulse search sequence, the encoder used to perform homing must be entered in the parameter P-AXIS-00388 [▶ 62] (cnc_homing_encoder).

In addition, control and status information must be transferred between the drive and the CNC to control the homing sequence. This can be performed either by using the real-time bits in the control or status word of the drive or by signal, control and status worlds. The axis parameter P-AXIS-00387 (cnc_homing_rt_bit_layout) sets how these bits are transferred. Control and status bits must also be assigned in the drive to match the set value of P-AXIS-00387. If the signal control and status words are used, they must be configured in the cyclic process data.

The reference cam is evaluated in the CNC. It can either be transferred to the CNC via the HLI or via the real-time status bit of the status word, see P-AXIS-00321 (reference_cam_signal).

The section SERCOS with zero pulse latch with S-0-146 [▶ 50] contains a parameterisation example.

CNC-controlled with manufacturer-specific zero pulse latch AX5000

For AX5000 drives from Beckhoff, a zero pulse latch can be executed by using the drive-internal latch logic without using the command S-0-146. The latched zero pulse is then transferred as measured value to the CNC: The CNC must then be parameterised for measuring with a SERCOS drive (see function description [FCT-C4]); in addition the occurrence of the zero pulse must be configured in the drive latch event. The CNC must be notified of the real-time control and real-time status bit used in the parameter kenngr.echtzeit_bit_nr (P-AXIS-00060). Please refer to the manufacturer's documentation for information on drive parameterisation.

With CNC-controlled homing, all the sequence variants described in the section Sequence strategies for homing [▶ 17] are available.

The reference position is set by the axis parameter P-AXIS-00152 (pos_refpkt).

This homing type is set by assigning the value 'CNC_CONTROLLED' to the axis parameter P-AXIS-00299 (homing_type).

The value 0 must be assigned to the axis parameter P-AXIS-00299) (homing_without_zero_pulse).

CNC-controlled at encoder overflow

If the encoder used in the drive supplies an absolute position during a motor revolution (this means the encoder position does not change when the drive is switched off and back on), the encoder overflow can be used for referencing instead of the zero pulse

The encoder can then mask and check a settable number of position value bits when this position overflows. This encoder overflow uniquely marks a mechanical motor position during a motor revolution and can then be used for referencing.

With CNC-controlled homing, all the sequence variants described in the section Sequence strategies for homing [▶ 17] are available.

This homing type is activated by setting the axis parameter P-AXIS-00294 (homing_overflow_evaluation) to 1. In addition set P-AXIS-00084 (homing_without_zero_pulse) to 0.

The number of bits of the actual value position transferred by the drive and used to calculate overflow must be entered in axis parameter P-AXIS-00355 (encoder_bit_range).

The axis parameter P-AXIS-00354 (encoder_overflow_offset) can shift the position of encoder overflow during a motor revolution.

The reference position is set by the axis parameter P-AXIS-00152 (pos_refpkt).

This referencing type only supplies reproducible results if the encoder used supplies an absolute position during a motor revolution. This means that, after the drive is switched off and on, the encoder position supplied by the drive must be identical if the mechanical motor position is identical. If in doubt, please refer to the drive documentation or contact the drive manufacturer.

3.1.2 Drive systems with reference cam

3.1.2.1 Reference cam present

With a drive system that has a reference cam, the system parameter P-AXIS-00156 (ref_ohne_nocken) must be set to 0. This is irrespective to whether the cam is only used for the homing sequence or also for referencing.

P-AXIS-00156 (ref_ohne_nocken)	0:	Reference cam present
	1:	Reference cam not present or used

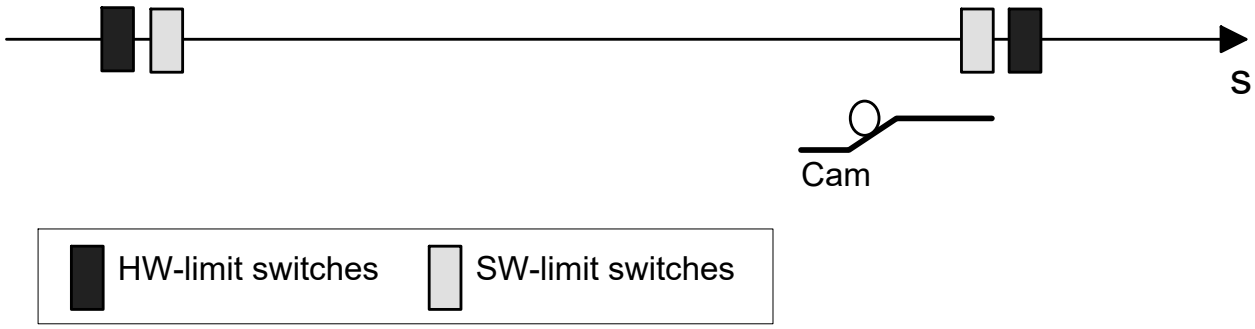

Fig. 16: Drive system with reference cam

3.1.2.2 Cam switch signal level

The level when the cam switch is operated can be either logic 0 (0-active) or 1 (1-active). The sequence parameter P-AXIS-00038 (cam_level) sets the level.

P-AXIS-00038 (cam_level)	0: 0-active
	1: 1-active

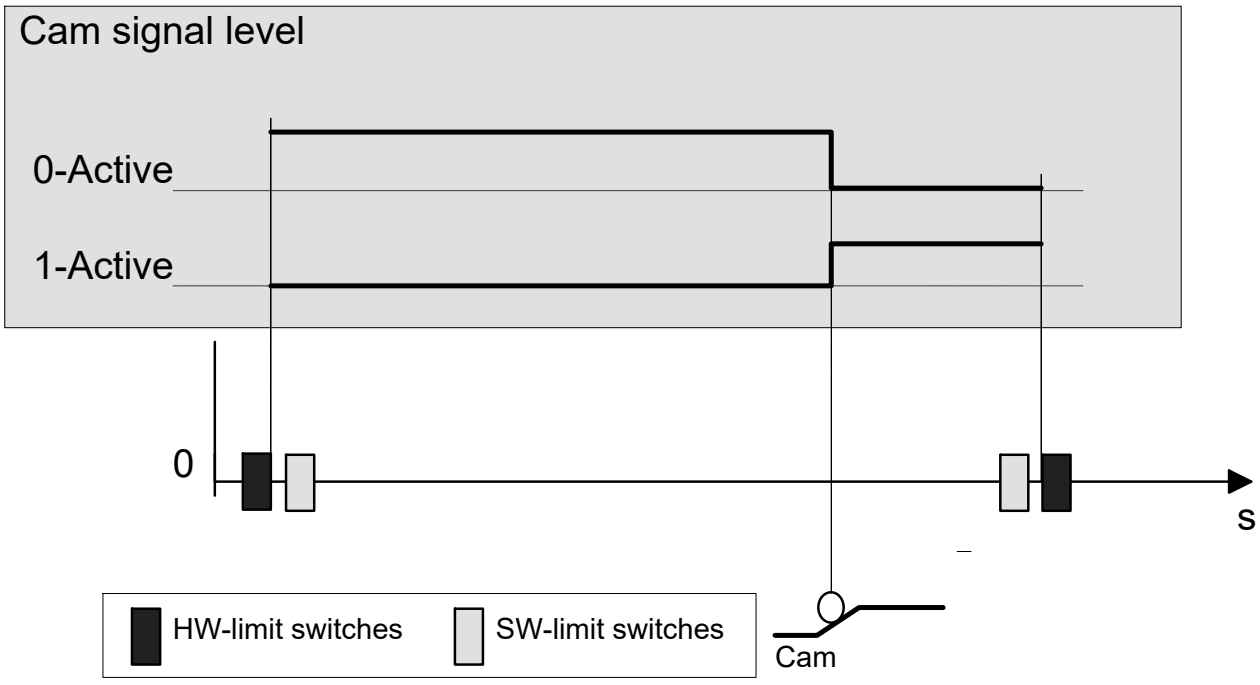

Fig. 17: Cam signal level

3.1.2.3 Access type on cam signal

The controller read the cam signal axis-specific via the HLI interface.

P-AXIS-00036 (cam_direct_access)	0:	Supply the reference cam signal in the HLI interface by the PLC

3.1.3 Drive systems with zero pulse

If the drive system has a zero pulse signal for referencing, the parameter P-AXIS-00084 (homing_without_zero_pulse) must be set to 0.

P-AXIS-00084 (homing_without_zero_pulse)	0: 1:	with zero pulse without zero pulse

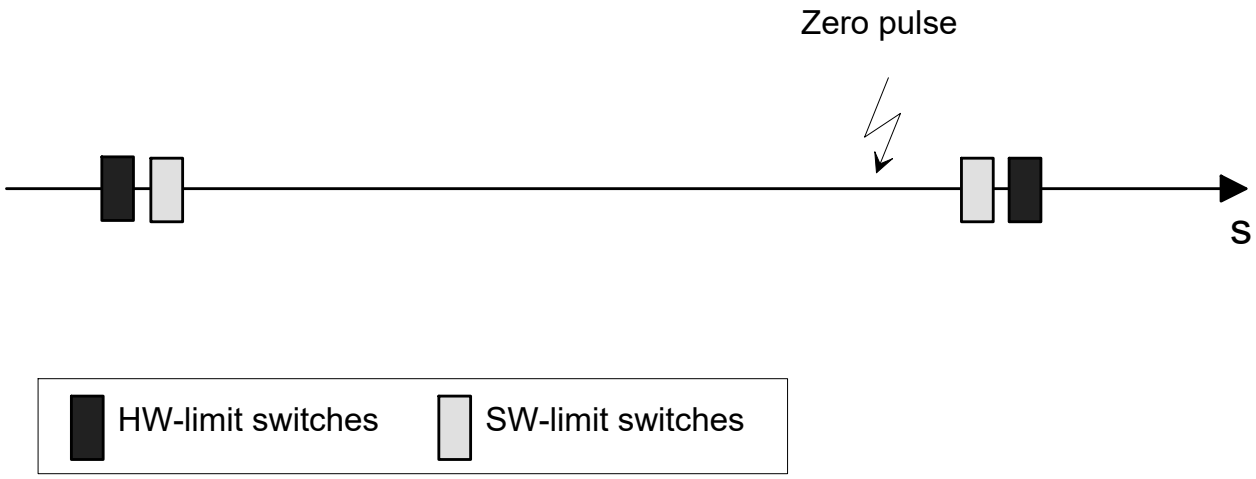

Fig. 18: Drive system with zero pulse

3.2 Sequence parameters

3.2.1 Homing with or without reversal

This parameter sets whether homing is to be executed in

- one phase or in
- several phases.

P-AXIS-00157 (ref_ohne_rev)	0: with reversal - multi-phase
	1: without reversal - single-phase

3.2.2 Motion direction during homing

P-AXIS-00158 (ref_richt)	1: Positive motion direction (in the direction of positive axis coordinates)
	0: Negative motion direction

The motion direction specified in the parameter P-AXIS-00158 (ref_richt) defines the motion direction if a cam switch is not operated for homing with cam (P-AXIS-00156 = 0).

3.2.3 Velocities for homing

There are 2 velocities for homing:

The parameter P-AXIS-00064 defines whether the homing velocity is faster or slower in phases 2 and 3.

P-AXIS-00219 (vb_refmax)	Fast velocity in [µm/s] or [°/s]
P-AXIS-00218 (vb_reflow)	Slow velocity in [µm/s] or [°/s]
P-AXIS-00064 (fast_from_cam)	0: Reversal with vb_reflow
	1: Reversal with b_refmax

The following applies: P-AXIS-00219 (vb_refmax) ≥ P-AXIS-00218 (vb_reflow).

3.2.4 Homing acceleration

Homing acceleration is set by the P-AXIS-00285 parameter. When a non-linear acceleration profile is used, the ramp time can be additionally set by the P-AXIS-00286 parameter.

If P-AXIS-00285 (acceleration) and P-AXIS-00286 (ramp time) are not parameterised or have the value 0, the following values are used:

- Acceleration: the minimum of the values P-AXIS-00005 and P-AXIS-00006 is used.
- Ramp time: If the parameter is 0 or too small, the value of P-AXIS-00201 is adopted.

3.3 Reference position

This parameter defines the position which is adopted by the controller – or the position controller – for referencing. This determines the required axis coordinate system.

P-AXIS-00152 (pos_refpkt)	Definition of reference position in [0.1µm] or [0.0001 °]

3.4 Specific parameter for drive simulation

This parameter is used for the “Drive simulation” drive type to define the distance up to referencing. In this case, homing is single-phase, i.e. with no reversal. No physical I/O is required.

The settings of other homing parameters are irrelevant for this drive type except for the parameter listed below.

P-AXIS-00161 (rpf_weg_bis_nip)	Distance up to referencing is in [0.1µm] or [0.0001 °]

3.5 Effectiveness of parameters

System parameters for homing:

	Measuring system type			
	Not absolute			absolute
	Only cam	only zero pulse	Cam and zero pulse	
	I	II	III	IV
ref_ohne_nocken	0	1	0	-
homing_without_zero_pulse	1	0	0	-
abs_pos_gueltig	0	0	0	1
cam_direct_access	0	-	0	-
cam_level	X	-	X	-

Effective parameters with individual homing modes

	Measuring system type			
	Not absolute			absolute
	Only cam	only zero pulse	Cam and zero pulse	
	I	II	III	IV
ref_ohne_rev	X	X	X	-
ref_richt	X	X	X	-
fast_from_cam	X	-	X	-
pos_refpkt	X	X	X	-
rpf_weg_bis_nip (simulation)	-	X	X	-
vb_reflow	X	X	X	-
vb_refmax	X	-	X	-

3.6 Parameterisation examples

3.6.1 Conventional drives

Excerpt from parameter list for X axis

```
# ************************************************
#    Axis machine data X axis
# ************************************************
#
kopf.achs_nr                                      1
kopf.mds_ident                                    1
kopf.log_achs_name                                X_axis
.....................................
#
kenngr.achs_mode                                  1
kenngr.achs_typ                                   1
.....................................
kenngr.ref_richt                                  0
kenngr.homing_without_zero_pulse                  0
kenngr.fast_from_cam                              1
kenngr.ref_ohne_nocken                            0
kenngr.vorz_richtung                              0
kenngr.beweg_richt                                0
kenngr.ref_ohne_rev                               0
.....................................
kenngr.antr_typ                                   5
kenngr.abs_pos_gueltig                            0
#
getriebe[0].nummer                                1
.....................................
getriebe[0].lslope_profil.a_grenz_stufe_1         10000
getriebe[0].lslope_profil.a_grenz_stufe_2         10000
getriebe[0].lslope_profil.vb_grenz_stufe_1_2      600000
.....................................
getriebe[0].vb_refmax                             100000
getriebe[0].vb_reflow                             20000
.....................................
getriebe[0].pos_refpkt                           -2025000
.....................................
lr hw[0].nummer                                   1
.....................................
lr_hw[0].cam_direct_access                        0

End
```

3.6.2 Simulation

Excerpt from parameter list for X axis

```
# ************************************************
#    Axis machine data X axis
# ************************************************
#
kopf.achs_nr                                      1
kopf.mds_ident                                    1
kopf.log_achs_name                                X_axis
.....................................
#
kenngr.achs_mode                                  1
kenngr.achs_typ                                   1
.....................................
kenngr.ref_richt                                  0

.....................................
kenngr.antr_typ                                   4
kenngr.abs_pos_gueltig                            0
#
getriebe[0].nummer                                1
.....................................
getriebe[0].lslope_profil.a_grenz_stufe_1         10000
getriebe[0].lslope_profil.a_grenz_stufe_2         10000
getriebe[0].lslope_profil.vb_grenz_stufe_1_2      600000
.....................................
getriebe[0].vb_refmax                             100000
getriebe[0].vb_reflow                             20000
.....................................
getriebe[0].pos_refpkt                           -2025000
.....................................
antr_simu.rpf_weg_bis_nip                         200

End
```

3.6.3 SERCOS with zero pulse latch with S-0-146

CNC-controlled homing with zero point latch by command S-0-146.

Encoder for homing is defined by reading out S-0-147. Bits 14 and 15 are used as real-time bits in the signal status and signal control word.

```
Excerpt from parameter list
kenngr.homing_type                          CNC_CONTROLLED
kenngr.homing_without_zero_pulse                         0
antr.sercos.drive_supports_cnc_homing                    1
antr.cnc_homing_encoder                                  1
antr.sercos.cnc_homing_rt_bit_layout                    16
```

The following parameters must be assigned in the drive:

S-0-147: Bit 2 = 0, Bit 4 = 1 (bit numbers counted from 0 in each case).

S-0-27 (assign signal control word): List element 14 = 407,

List element 15 = 404.

S-0-26 (assign signal status word): List element 14 = 408,

List element 15 = 403.

S-0-144 and S-0-145 must be configured in the cyclic process data.

4 Parameter

4.1 Overview

ID	Parameter	Description
P-AXIS-00014	abs_pos_gueltig	Identification code for absolute path measurement system
P-AXIS-00015	achs_mode	Axis mode
P-AXIS-00036	cam_direct_access	Access to reference cam
P-AXIS-00038	cam_level	Signal level for reference cam signal
P-AXIS-00064	fast_from_cam	Slow / fast movement down to reference cam
P-AXIS-00074	gantry_slave_no_homing	Suppress homing for gantry slave axis
P-AXIS-00084	homing_without_zero_pulse	Referencing with or without zero pulse signal
P-AXIS-00152	pos_refpkt	Position of the reference point
P-AXIS-00156	ref_ohne_nocken	Referencing with or without reference cam
P-AXIS-00157	ref_ohne_rev	Referencing with or without reversal
P-AXIS-00158	ref_richt	Motion direction when referencing
P-AXIS-00161	rpf_weg_bis_nip	Distance up to receipt of zero pulse with simulated homing
P-AXIS-00218	vb_reflow	Slow velocity of homing
P-AXIS-00219	vb_refmax	Fast velocity of homing
P-AXIS-00294	homing_overflow_evaluation	Referencing to encoder overflow
P-AXIS-00299	homing_type	Homing type
P-AXIS-00321	reference_cam_signal	Receipt of reference cam signal (SERCOS only)
P-AXIS-00354	encoder_overlow_offset	Encoder overflow offset
P-AXIS-00355	encoder_bit_range	Encoder bit width for referencing to encoder overflow
P-AXIS-00386	drive_supports_cnc_homing	Execute CNC-controlled homing with zero pulse latch via S-0-146 (SERCOS only).
P-AXIS-00387	cnc_homing_rt_bit_layout	Assign the real-time control and status bits to the CNC-controlled homing with zero pulse latch via S-0-146 (SERCOS only).
P-AXIS-00388	cnc_homing_encoder	Define the encoder used for homing.
P-AXIS-00412	homing_max_movement_dist	Maximum permitted distance for homing.
P-AXIS-00425	reference_check.bit_nr	Bit number of the bit used for reference monitoring.
P-AXIS-00426	reference_check.-element_name	Name of the cyclic process data element in which the reference signal is transferred.
P-AXIS-00494	shift_offset_zero_pulse_activation	Delayed activation of zero pulse logic for CNC-controlled homing.

4.2 Description

P-AXIS-00014	**Identification code for absolute path measurement system**
Description	If an absolute path measurement system is used, then the parameter must be set to 1. So no homing is necessary.
Parameter	kenngr.abs_pos_gueltig
Data type	BOOLEAN
Data range	0/1
Axis types	T, R, S

Dimension	T: ----	R,S: ----
Default value	0	
drive types.	Simulation, SERCOS,	
Remarks		

P-AXIS-00015	**Axis mode**	
Description	Axes can be traversed in different operating modes.	
Parameter	kenngr.achs_mode	
Data type	UNS32	
Data range	0x00000001 - 0x10000000	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0x00000001	
Drive types	----	
Remarks		

The following operation modes can be parameterised[(1)]:

Value	Meaning		Axis type	Interpolator type	
	Description	**ACHSMODE_**		**Path**	**Spindle**
0x00000001	The axis is operated like a linear axis; no modulo calculation is executed. For example, rotary axis with restricted motion range; must be set as default for linear axes.	..LINEAR[(1)]	T, R	X	
0x00000004	A modulo calculation is always executed after the target position is reached. Regardless of the operation mode selected for rotary axes, a modulo calculation is always executed in the position controller. In this way, modulo circle compensation can be executed if required.	..MODULO[(1)]	R	X	X
0x00000040	Axis is used as a face turning axis (turning functions).	..PLANDREHEN	T	X	
0x00000080	Axis is used as a longitudinal turning axis (turning functions).	..LAENGSDREHEN	T	X	
0x00000100	In the case of a spindle, automatic referencing before spindle set-up can be prevented. This is only relevant if the axis is not referenced. The function is drive-dependent.	..KEINE_AUTO_RPF	R		X
0x00000200	Axis for kinematic 'C axis' transformation.	..CAX	R	X	X
0x00000400	Modulo calculation for linear axis. (Example: conveyor belt with drive motor where the position on the belt is programmed in mm).	..MODULO_LINEAR	R	X	
0x00000800	Axis is released for mechanical blocking by the PLC. This axis mode is not available for TwinCAT systems.	..CLAMPABLE	T, R	X	
0x00001000	Axis carries a rotary workpiece table.	..ROT_TABLE	T, R	X	
0x00008000	Monitoring of axis collision.	..COLL_CHECK	T	X	
0x00010000	Master axis of gantry coupling.	..GANTRY_MASTER	T, R	X	
0x00020000	Slave axis of gantry coupling.	..GANTRY_SLAVE	T, R	X	
0x00040000	Identifier for PLC spindle with axis interface	..SPINDLE_EXT_CTRL	R		X
0x00080000	Input axis for additional external position command values (e.g. distance control).	..EXT_CTRL_INPUT	T	X	
0x00100000	Pure encoder axis, only to display actual values (e.g. conveyor belt).	..COUNTER	T, R	X	X
0x00200000	Lead axis in combination with single feed axis and G194 (contouring with DIST_MASTER)	..LEAD_AXIS	T, R	X	
0x00400000	The resolution (wegaufz/wegaufn) of this axis can be changed.	..ALLOW_RESOLUTION_CHANGE[(2)]	T, R	X	X
0x00800000	Path-dependent dynamic weighting for this axis is possible.	..DYNAMIC_WEIGHTING	T, R	X	

Value	Meaning		Axis type	Interpolator type	
0x02000000	Path axis for tool centre point path	..PATH_LENGTH_TCP	R	X	
0x04000000	Path axis for contour path	..PATH_LENGTH_CONTOUR	R	X	
0x08000000	Virtual lead axis for path interpolation	..VIRT_LEAD_AXIS	R	X	
0x10000000	Axis carries the pressure roller for edge bending.	..LAH_OFFSET_AXIS	R	X	

(1) One of the two following axis modes **must** always be specified:

- ACHSMODE_LINEAR or
- ACHSMODE_MODULO

All other bits of the parameter *achs_mode* are additional specifications. For example, the ACHSMODE_MODULO_LINEAR bit is only useful if combined with the ACHSMODE_MODULO bit.

(2) Changing certain axis parameters while the controller is running may be critical, e.g. path resolution. Therefore, this parameter can be enabled by setting the bit ALLOW_RESOLUTION_CHANGE in axis mode. Otherwise these parameters (P-AXIS-00234, P-AXIS-00233) can no longer be changed after the controller is started.

When the bit ALLOW_RESOLUTION_CHANGE is set, a check is first made whether the axis is interpolated, also when other critical parameters change. If the axis is currently in motion, this parameter update is rejected.

P-AXIS-00036	Access to cam signals	
Description	The parameter defines the access to cam signals.	
Parameter	lr_hw[i].cam_direct_access	
Data type	BOOLEAN	
Data range	0/1	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	1	
drive types.	Conventional, Terminal, Lightbus, Profidrive	
Remarks	This entry is not adopted when the axis parameter list is updated. Updates only become effective when the controller is rebooted.	

P-AXIS-00038	Level of cam signals	
Description	The parameter defines the level of cam signals.	
Parameter	lr_hw[i].cam_level	
Data type	BOOLEAN	
Data range	0: 0-signal is active level. When the reference cam switch is actuated, the value of the control unit element pAC[axis_idx]^.addr^.McControlLr_Data.MCControlBoolUnit_ReferenceCam.X_Command on the HLI is FALSE (see [HLI]). 1: 1-signal is active level (default). When the reference cam switch is actuated, the value of the control unit element pAC[axis_idx]^.addr^.McControlLr_Data.MCControlBoolUnit_ReferenceCam.X_Command on the HLI is TRUE (see [HLI]).	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	1	
drive types.	Conventional, Terminal, Lightbus, Profidrive	
Remarks		

P-AXIS-00064	Slow / fast movement down from cam	
Description	This parameter sets the velocity during reversion down from cam.	
Parameter	kenngr.fast_from_cam	
Data type	BOOLEAN	
Data range	0: Slow movement down from cam 1: Fast movement down from cam (default)	
Axis types	T, R	
Dimension	T: ----	R: ----
Default value	1	
drive types.	----	
Remarks	For further hardware-specific parameters relating to homing with cam, see P-AXIS-00036 - P-AXIS-00039.	

P-AXIS-00074	Suppress homing for gantry slave axis	
Description	This parameter can suppress the homing of gantry slave axes. When homing of the master axis is completed, the reference positions entered in the axis parameter lists of the slave axes are also adopted and monitoring of the gantry difference is started.	
Parameter	kenngr.gantry_slave_no_homing	
Data type	BOOLEAN	
Data range	0/1	
Axis types	T, R	
Dimension	T: ----	R: ----
Default value	0	
drive types.	----	
Remarks	This parameter is not supported in the case of spindle axes.	

P-AXIS-00084	Homing only with cam (without zero pulse)	
Description	The homing position is detected by travel on the cam.	
Parameter	kenngr.homing_without_zero_pulse	
Data type	BOOLEAN	
Data range	0: Homing with zero pulse of rotary transducer (default value). 1: Homing without zero pulse of rotary transducer (low accuracy).	
Axis types	T, R	
Dimension	T: ----	R:----
Default value	0	
drive types.	----	
Remarks	For further hardware-specific parameters relating to homing with cam, see P-AXIS-00036 - P-AXIS-00039.	

P-AXIS-00152	Position of the reference point	
Description	If homing is completed, the value from the parameter P-AXIS-00152 is taken as the absolute position for the axis	
Parameter	getriebe[i].pos_refpkt	
Data type	SGN32	
Data range	swe_neg < pos_refpkt < swe_pos	
Axis types	T, R, S	
Dimension	T: 0.1 µm	R,S: 0.0001 °
Default value	0	
drive types.	Simulation, Conventional, Terminal, Lightbus, Profidrive, CANopen	
Remarks		

P-AXIS-00156	Homing without cam	
Description	A changeover of homing strategy can be carried out so that homing is done without cam (e.g. only with zero pulse), i.e. without reverting. In this case the parameter P-AXIS-00156 should be set to TRUE.	
Parameter	kenngr.ref_ohne_nocken	
Data type	BOOLEAN	
Data range	0/1	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
drive types.	Conventional, Terminal, Lightbus, Profidrive	
Remarks	To be assigned for analogue spindles only. If P-AXIS-00156 is assigned with 1 (TRUE), then it is **imperative that** P-AXIS-00157 is assigned with 1 (TRUE).	

P-AXIS-00157	Homing without reverting	
Description	Via parameter P-AXIS-00157 a restriction of homing can occur that will prohibit any reverting.	
Parameter	kenngr.ref_ohne_rev	
Data type	BOOLEAN	
Data range	0/1	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
drive types.	Conventional, Terminal, Lightbus, Profidrive	
Remarks	The speed during reversing is set with the parameter P-AXIS-00064 (fast_from_cam). By reverting, it is possible to repeatedly move to the reference cam at slow speed. To be assigned for analogue spindles only. P-AXIS-00157 **must** be assigned with 1 (TRUE) if P-AXIS-00156 is assigned with 1 (TRUE).	

P-AXIS-00158	Preferred direction of axis for homing	
Description	The parameter P-AXIS-00158 specifies the direction of travel if the axis does not remain on a cam. The declaration of the signal level when the reference switch is actuated is given by the axis parameter P-AXIS-00038.	
Parameter	kenngr.ref_richt	
Data type	BOOLEAN	
Data range	0: Negative direction 1: Positive direction	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
drive types.	Simulation, Conventional, Terminal, Lightbus, Profidrive	
Remarks	Positive direction signifies that the coordinate values increase. Negative direction signifies that the coordinate values decrease.	

P-AXIS-00161	Tool path up to zero pulse during homing simulation
Description	The parameter defines the tool path up to zero pulse during homing simulation.
Parameter	antr.simu.rpf_weg_bis_nip
Data type	SGN32
Data range	MIN(SGN32) ≤ rpf_weg_bis_nip ≤ MAX(SGN32)
Axis types	T, R, S

Dimension	T: 0.1µm	R,S: 0.0001 °
Default value	10	
drive types.	Simulation	
Remarks		

P-AXIS-00218	**Slow velocity for exact detection of reference position**	
Description	Not only the traverse downwards of cam but also the traverse on cam with homing takes place at the velocity P-AXIS-00218.	
Parameter	getriebe[i].vb_reflow	
Data type	UNS32	
Data range	1 ≤ vb_reflow ≤ P-AXIS-00219	
Axis types	T, R, S	
Dimension	T: µm/s	R,S: 0.001°/s
Default value	16666	
drive types.	Simulation, Conventional, Terminal, Lightbus, Profidrive	
Remarks		

P-AXIS-00219	**Fast velocity for detection of reference cam**	
Description	At start of homing, if the axis is not on the cam, then travel on the cam takes place at the velocity defined in P-AXIS-00219.	
Parameter	getriebe[i].vb_refmax	
Data type	UNS32	
Data range	P-AXIS-00218 ≤ vb_refmax ≤ P-AXIS-00212	
Axis types	T, R, S	
Dimension	T: µm/s	R,S: 0.001°/s
Default value	83333	
drive types.	Conventional, Terminal, Lightbus, Profidrive	
Remarks		

P-AXIS-00294	**Selection of the homing method 'Evaluation of encoder overflow'**	
Description	This homing method is selected with the parameter P-AXIS-00294. To use this option, the parameter P-AXIS-00084 must be assigned the value 0. The number of bits used to detect encoder overflow has to be set in parameter P-AXIS-00355 .	
Parameter	kenngr.homing_overflow_evaluation	
Data type	BOOLEAN	
Data range	0: No evaluation of encoder overflow (default). 1: Evaluation of encoder overflow.	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
drive types.	Lightbus	
Remarks	This homing method only leads to a repeatable homing position of the axis when encoder overflow occurs every time at the same mechanical position of the axis. This is true for example for resolver encoders.	

P-AXIS-00299	**Homing type**
Description	There are two different homing methods: 1. NC-controlled homing 2. Drive-controlled homing

	With NC-controlled homing, the generation of command values and sequence control (evaluation of reference cams and zero pulses) are handled in the CNC. With drive-controlled homing, motion generation and the evaluation of cam signals and zero pulses are handled in the drive. The homing method can be set up for drives types (P-AXIS-00018) for which both homing methods are implemented with this parameter.
Parameter	kenngr.homing.homing_type * (Note: see *-note below)
Data type	STRING
Data range	CNC_CONTROLLED: CNC-controlled homing is done. DRIVE_CONROLLED: Drive-controlled homing is done. DISABLED: This axis cannot be homed. The CNC generates the error message P-ERR-50685 or P-ERR-60313 if homing is commanded for the axis (e.g. G74). This setting is only intended for axes with an absolute measuring system (see P-AXIS-00014). IGNORE_ABS_POS: Axes with this setting are ignored during homing, i.e. the axis is not homed even if G74 <axis_name> is programmed. In this case the CNC generates no error message contrary to the setting DISABLED. The mode IGNORE_ABS_POS is only permitted for axis with an absolute position measuring system, meaning the parameter kenngr.abs_pos_gueltig (see P-AXIS-00014) must be set to 1. Otherwise, the CNC generates the error warning P-ERR-110584.
Axis types	T, R, S
Dimension	T: ---- R,S: ----
Default value	CNC_CONTROLLED
Drive types	----
Remarks	* *alternative: kenngr.homing_type (old syntax)* If the homing command G74 involves multiple axes with different homing type setting e.g. G74 X1 Y1 Z2, the axis with kenngr.homing_type != IGNORE_ABS_POS/ DISABLED will move and try to find the homing switch while there is no movement on the homing suppressed axes. Therefore it must be ensured that no collision can occur. If a homing type which is not supported by the drive type is set up, an error P-ERR-110384 is generated and default homing type is corrected. If this entry is not present in the parameter list, the default homing type is used according to the drive type:

Drive type	CNC_CONTROLLED	DRIVE_CONTROLLED
Simulation	X*	
SERCOS	X	X*
Terminal	X*	
Lightbus	X*	
RT-Ethernet	X*	
PROFIDRIVE	X*	
CANopen	X*	X
* Default homing type		

P-AXIS-00321	**Input interface for reference cam signal**	
Description	In the default setting with CNC-controlled homing, the reference cam signal is read from the HLI [HLI]. For some drive types it is possible to use the drive digital inputs as reference cam input. In this case the appropriate input has to be configured in P-AXIS-00321. If this parameter is not set, the reference cam signal is read from the PLC interface.	
Parameter	antr.reference_cam_signal	
Data type	STRING	

Data range	Dependent on the drive type the following different names for the digital inputs are possible: **Drive type SERCOS:** PLC Read reference cam signal from HLI (default) RT_STATUS_BIT_1 Read reference cam signal from real time status bit 1 RT_STATUS_BIT_2 Read reference cam signal from real time status bit 2 **Drive type CANopen:** PLC Read reference cam signal from HLI (default) STATUS_DIG_INPUTS (*) Reference cam signal from object 0x60FD : Digital inputs
Axis types	T, R, S
Dimension	T: ---- R,S: ----
Default value	PLC
drive types.	SERCOS, Lightbus,CANopen
Remarks	**Caution:** It is **only** possible to use real-time status bits with NC-controlled homing, see also [CMS-A1]. If the drive digital inputs are used, they must also be parameterised using the drive manufacturer's set-up tool. The transmission of the digital inputs in the cyclic telegram must also be configured. (*) For the transmission of the reference cam state, the object 0x60FD: Digital inputs must be configured (see DS402 drive profile). Otherwise, the error message with error code P-ERR-70292 is output.

P-AXIS-00354	**Shifting of encoder overflow**
Description	When homing with encoder overflow this parameter can shift the reference position. A positive value for P-AXIS-00354 will shift the reference position in the positive movement direction of the axis.
Parameter	antr.encoder_overflow_offset
Data type	SGN32
Data range	application-specific
Axis types	T, R, S
Dimension	T: 0.1 µm R,S: 0.1 µm
Default value	0
drive types.	SERCOS, Lightbus,CANopen
Remarks	The reference position can only be shifted within one encoder revolution. If larger values for P-AXIS-00354 are defined, the error message P-ERR-70310 is output and P-AXIS-00354 is corrected to 0.

P-AXIS-00355	**Number of bits for evaluation of encoder overflow**
Description	When homing on encoder overflow, this parameter defines the number of bits of the drive's actual position value that are taken into account to detect encoder overflow. The actual position value of the drive system is AND-combined with the value ($2^{\text{P-AXIS-00355}}$ -1) and the underflow or overflow of the resulting value is considered as encoder overflow.
Parameter	antr.encoder_bit_range
Data type	UNS08
Data range	1 … 31
Axis types	T, R, S
Dimension	T: ---- R,S: ----

Default value	0
drive types.	SERCOS, Lightbus,CANopen
Remarks	

P-AXIS-00386	**Drive supported execution of the CNC based homing (SERCOS)**	
Description	By default CNC-controlled homing for SERCOS drives is only executed in the controller; the drive-internal positions are not altered. If the drive supports the SERCOS command S-0-146 (CNC-controlled homing), this parameter can enable the command S-0-146 for CNC-controlled homing. The advantage of this method is that, after homing is finished, the drive-internal positions are also referenced so that drive-internal software limit switches can be used, for example. The reference position used for homing is P-AXIS-00152. This value is transferred to the drive during homing	
Parameter	antr.sercos.drive_supports_cnc_homing	
Data type	BOOLEAN	
Data range	0/1	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
drive types.	SERCOS	
Remarks	This parameter is currently not supported for spindles. In addition to command S-0-146 the drive must support the following commands: • S-0-171 (Calculate displacement) • S-0-172 (Displacement to referenced system) • S-0-191 (Cancel reference point procedure) For further information please refer to the drive manufacturer's documentation..	

P-AXIS-00387	**Assignment of control and status bits for CNC based homing (SERCOS)**	
Description	To execute CNC-controlled homing with drive support, two control bits and two status bits are required. The real-time control and status bits can be used in the drive control and status word or alternatively as bits in the signal status and signal control word.	
Parameter	antr.sercos.cnc_homing_rt_bit_layout	
Data type	UNS16	
Data range	1 ≤ cnc_homing_rt_bit_layout ≤ 16	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
drive types.	SERCOS	
Remarks	When the status and control bits are transferred in the signal status and control words, they must be configured in the cyclic process data, otherwise the error message P-ERR-70295 is output.	

Assign the values of P-AXIS-00387 to the possible bit assignments:

Value	Process data	Bit number	Meaning	Ident
1	Control word	Real-time bit 1 (S-0-301)	Homing enable	S-0-407
		Real-time bit 2 (S-0-303)	Position command value referenced	S-0-404
	Status word	Real-time bit 1 (S-0-305)	Position marker pulse detected	S-0-408
		Real-time bit 2 (S-0-307)	Actual value referenced	S-0-403

Value	Process data	Bit number	Meaning	Ident
2	Signal control word	Bit 0 (S-0-27[0])	Homing enable	S-0-407
		Bit 1 (S-0-27[1])	Position command value referenced	S-0-404
	Signal status word	Bit 0 (S-0-26[0])	Position marker pulse detected	S-0-408
		Bit 1 (S-0-26[1])	Actual value referenced	S-0-403
3	Signal control word	Bit 1 (S-0-27[1])	Homing enable	S-0-407
		Bit 2 (S-0-27[2])	Position command value referenced	S-0-404
	Signal status word	Bit 1 (S-0-26[1])	Position marker pulse detected	S-0-408
		Bit 2 (S-0-26[2])	Actual value referenced	S-0-403
4	Signal control word	Bit 2 (S-0-27[2])	Homing enable	S-0-407
		Bit 3 (S-0-27[3])	Position command value referenced	S-0-404
	Signal status word	Bit 2 (S-0-26[2])	Position marker pulse detected	S-0-408
		Bit 3 (S-0-26[3])	Actual value referenced	S-0-403
5	Signal control word	Bit 3 (S-0-27[3])	Homing enable	S-0-407
		Bit 4 (S-0-27[4])	Position command value referenced	S-0-404
	Signal status word	Bit 3 (S-0-26[3])	Position marker pulse detected	S-0-408
		Bit 4 (S-0-26[4])	Actual value referenced	S-0-403
6	Signal control word	Bit 4 (S-0-27[4])	Homing enable	S-0-407
		Bit 5 (S-0-27[5])	Position command value referenced	S-0-404
	Signal status word	Bit 4 (S-0-26[4])	Position marker pulse detected	S-0-408
		Bit 5 (S-0-26[5])	Actual value referenced	S-0-403
7	Signal control word	Bit 5 (S-0-27[5])	Homing enable	S-0-407
		Bit 6 (S-0-27[6])	Position command value referenced	S-0-404
	Signal status word	Bit 5 (S-0-26[5])	Position marker pulse detected	S-0-408
		Bit 6 (S-0-26[6])	Actual value referenced	S-0-403
8	Signal control word	Bit 6 (S-0-27[6])	Homing enable	S-0-407
		Bit 7 (S-0-27[7])	Position command value referenced	S-0-404
	Signal status word	Bit 6 (S-0-26[6])	Position marker pulse detected	S-0-408
		Bit 7 (S-0-26[7])	Actual value referenced	S-0-403
9	Signal control word	Bit 7 (S-0-27[7])	Homing enable	S-0-407
		Bit 8 (S-0-27[8])	Position command value referenced	S-0-404
	Signal status word	Bit 7 (S-0-26[7])	Position marker pulse detected	S-0-408
		Bit 8 (S-0-26[8])	Actual value referenced	S-0-403
10	Signal control word	Bit 8 (S-0-27[8])	Homing enable	S-0-407
		Bit 9 (S-0-27[9])	Position command value referenced	S-0-404
	Signal status word	Bit 8 (S-0-26[8])	Position marker pulse detected	S-0-408
		Bit 9 (S-0-26[9])	Actual value referenced	S-0-403
11	Signal control word	Bit 9 (S-0-27[9])	Homing enable	S-0-407
		Bit 10 (S-0-27[10])	Position command value referenced	S-0-404
	Signal status word	Bit 9 (S-0-26[9])	Position marker pulse detected	S-0-408
		Bit 10 (S-0-26[10])	Actual value referenced	S-0-403

Value	Process data	Bit number	Meaning	Ident
12	Signal control word	Bit 10 (S-0-27[10])	Homing enable	S-0-407
		Bit 11 (S-0-27[11])	Position command value referenced	S-0-404
	Signal status word	Bit 10 (S-0-26[10])	Position marker pulse detected	S-0-408
		Bit 11 (S-0-26[11])	Actual value referenced	S-0-403
13	Signal control word	Bit 11 (S-0-27[11])	Homing enable	S-0-407
		Bit 12 (S-0-27[1]2)	Position command value referenced	S-0-404
	Signal status word	Bit 11 (S-0-26[11])	Position marker pulse detected	S-0-408
		Bit 12 (S-0-26[1]2)	Actual value referenced	S-0-403
14	Signal control word	Bit 12 (S-0-27[12])	Homing enable	S-0-407
		Bit 13 (S-0-27[13])	Position command value referenced	S-0-404
	Signal status word	Bit 12 (S-0-26[12])	Position marker pulse detected	S-0-408
		Bit 13 (S-0-26[13])	Actual value referenced	S-0-403
15	Signal control word	Bit 13 (S-0-27[13])	Homing enable	S-0-407
		Bit 14 (S-0-27[1]4)	Position command value referenced	S-0-404
	Signal status word	Bit 13 (S-0-26[13])	Position marker pulse detected	S-0-408
		Bit 14 (S-0-26[14])	Actual value referenced	S-0-403
16	Signal control word	Bit 14 (S-0-27[14])	Homing enable	S-0-407
		Bit 15 (S-0-27[15])	Position command value referenced	S-0-404
	Signal status word	Bit 14 (S-0-26[14])	Position marker pulse detected	S-0-408
		Bit 15 (S-0-26[15])	Actual value referenced	S-0-403

P-AXIS-00388	**Encoder, used for CNC controlled homing (SERCOS)**	
Description	Some drive types support the use of multiple encoders (motor encoder and external encoder). This parameter defines which encoder is used for homing.	
Parameter	antr.cnc_homing_encoder	
Data type	SGN16	
Data range	0: Value is not configured. If P-AXIS-00386 is set to 1, set this parameter to a valid value (0, 1, 2). 1: The encoder used for homing is determined automatically, e.g. for SERCOS drives, by reading drive parameter S-0-147. 2: Motor encoder 3: External encoder	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
drive types.	SERCOS	
Remarks	At the moment this parameter is supported only for SERCOS. With SERCOS drives, if the encoder set in S-0-147 does not fit to the value set in P-AXIS-00388, the error message error message P-ERR-70453 is output. This value is only effective when P-AXIS-00386 has the value 1.	

P-AXIS-00412	**Maximum distance during homing**
Description	This parameter defines a maximum distance for homing for spindles and rotary axes. If the maximum permissible homing distance is exceeded, homing is aborted and error message P-ERR-70394 is output.

	It achieves that homing is aborted if, for example, the reference cam is not found due to a wiring error. This parameter works only for spindles and rotary axes, see P-AXIS-00018. If this parameter is set for linear axes to a value unequal to zero, the error message P-ERR-110545 is output and the parameter is corrected to 0. A value of 0 disables distance monitoring during homing.	
Parameter	kenngr.distc.a_max	
Data type	UNS32	
Data range	0 ≤ homing_max_movement_dist ≤ MAX(UNS32)	
Axis types	R, S	
Dimension		R,S: 0.0001 °
Default value	0	
drive types.	----	
Remarks	This parameter has to be set to a value which is at least equal to the modulo range of the axis in order to complete homing successfully.	

P-AXIS-00425	**Bit number of signal 'Drive is referenced' during reference monitoring**	
Description	In this parameter enter the number of the bit which is used for transmission of the signal 'Drive is referenced' from the drive to the controller during active reference monitoring. The least significant bit has bit number 0. The maximum value depends on the length of the configured telegram element which is used for transmission.	
	Length of telegram element	Max. bit number
	-1	No reference monitoring
	2	15
	4	31
	Setting the parameter to an invalid bit number leads to the output of error message P-ERR-110549.	
Parameter	antr.reference_check.bit_nr	
Data type	SGN16	
Data range	0 ≤ bit_nr ≤ Max. bit number	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	-1	
drive types.	SERCOS	
Remarks	This parameter is supported for SERCOS drive types only.	

P-AXIS-00426	**Element name of signal 'Drive is referenced' during reference monitoring**	
Description	In this parameter enter the name of the element of the cyclic input process data which is used for transmission of the signal 'Drive is referenced' from the drive. When the set-up value of P-AXIS-00426 is not found within the cyclic process, the error message P-ERR-70401 is output.	
Parameter	antr.reference_check.element_name	
Data type	STRING	
Data range	<*Empty string*>: Reference monitoring is disabled S-0-0135: When the SERCOS state word is used for transmission of the reference signal, the parameter has to be set to 'S-0-0135'… <*Telegram_element_Name*>: ...or, alternatively, the name of a telegram element configured in the cyclic process data.	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----

Default value	
Drive types	SERCOS
Remarks	Reference monitoring is activated by assigning a value to this parameter. When reference monitoring is activated, the parameter P-AXIS-00425 must also be assigned a valid value. At the moment, this parameter is supported for drive type SERCOS only. Changing this parameter by a list update is not possible (P-ERR-110550).

P-AXIS-00494	**Delayed activation of zero pulse logic**	
Description	For CNC-controlled homing (see P-AXIS-00299) the parameter delays the activation of the zero pulse logic after the actuation of the reference switch. This can be useful if the reference cam and the zero pulse are situated closely together and the detection of the zero pulse is therefore not reliably possible. In this case the next or the next but one zero pulse after the reference cam could be detected depending on the actuation speed of the reference cam.	
Parameter	kenngr.shift_offset_zero_pulse_activation	
Data type	UNS32	
Data range	0 ≤ shift_offset_zero_pulse_activation ≤ MAX_UNS32	
Axis types	T, R, S	
Dimension	T: 0.1 µm	R,S: 0.0001 °
Default value	0	
drive types.	Conventional, SERCOS, Terminal, Lightbus, Profidrive, CANopen	
Remarks		

4.3 Dependence on the type of referencing method

As already mentioned, different referencing methods are available. A method is selected by a specification in each axis MDS (achsmds*X*.lis) by the element kenngr.homing_type. Here, the method is selected by means of a defined string.

Refer to the table below for details of the methods available:

Method	**Keyword**
Move to fixed stop, NC-controlled	TORQ
Compatibility mode	NONE

Axis response with referencing type NONE

- If commanding was executed, the value is adopted as reference position for the axis. This value is stored in the element “**getriebe[i].pos_refpkt**“ in the axis MDS (achsmds*X*.lis)
- The behaviour of the axis during commanding depends on the defined drive type. If the drive type **DSE** is parameterised for the axis (see kenngr.antr_typ), the axis does not move when the FB is commanded. The parameterised reference position is adopted directly and the “Done” output is set to TRUE.
- If the drive type **Simulation** is parameterised for the axis (see kenngr.antr_typ), the axis moves and adopts the parameterised reference position after a short distance.

Axis behaviour in the case of the referencing type TORQ

- If the drive type **DSE** is parameterised for the axis, the axis does not move when the FB is commanded.
- If the referencing type **TORQ** Is used, further parameters can be assigned values in the axis MDS (achsmds*X*.lis). There are general parameters that refer to the referencing operation as such. In the axis list, they are indicated by the prefix **kenngr.homing.**

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Beckhoff Headquarters

Beckhoff Automation GmbH & Co. KG

Huelshorstweg 20
33415 Verl
Germany

Phone:	+49 5246 963-0
e-mail:	info@beckhoff.com
web:	www.beckhoff.com

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More Information:
www.beckhoff.com/TF5200

Beckhoff Automation GmbH & Co. KG
Hülshorstweg 20
33415 Verl
Germany
Phone: +49 5246 9630
info@beckhoff.com
www.beckhoff.com