Function Block “Homing_V90PN” for smart referencing solutions

SINAMICS V90PN / V1.0 / Homing / Telegram 111

https://support.industry.siemens.com/cs/ww/en/view/109747655

Siemens Industry Online Support

Legal information

Use of application examples

Application examples illustrate the solution of automation tasks through an interaction of several components in the form of text, graphics and/or software modules. The application examples are a free service by Siemens AG and/or a subsidiary of Siemens AG (“Siemens”). They are non-binding and make no claim to completeness or functionality regarding configuration and equipment. The application examples merely offer help with typical tasks; they do not constitute customer-specific solutions. You yourself are responsible for the proper and safe operation of the products in accordance with applicable regulations and must also check the function of the respective application example and customize it for your system.

Siemens grants you the non-exclusive, non-sublicensable and non-transferable right to have the application examples used by technically trained personnel. Any change to the application examples is your responsibility. Sharing the application examples with third parties or copying the application examples or excerpts thereof is permitted only in combination with your own products. The application examples are not required to undergo the customary tests and quality inspections of a chargeable product; they may have functional and performance defects as well as errors. It is your responsibility to use them in such a manner that any malfunctions that may occur do not result in property damage or injury to persons.

Disclaimer of liability

Siemens shall not assume any liability, for any legal reason whatsoever, including, without limitation, liability for the usability, availability, completeness and freedom from defects of the application examples as well as for related information, configuration and performance data and any damage caused thereby. This shall not apply in cases of mandatory liability, for example under the German Product Liability Act, or in cases of intent, gross negligence, or culpable loss of life, bodily injury or damage to health, non-compliance with a guarantee, fraudulent non-disclosure of a defect, or culpable breach of material contractual obligations. Claims for damages arising from a breach of material contractual obligations shall however be limited to the foreseeable damage typical of the type of agreement, unless liability arises from intent or gross negligence or is based on loss of life, bodily injury or damage to health. The foregoing provisions do not imply any change in the burden of proof to your detriment. You shall indemnify Siemens against existing or future claims of third parties in this connection except where Siemens is mandatorily liable.

By using the application examples you acknowledge that Siemens cannot be held liable for any damage beyond the liability provisions described.

Other information

Siemens reserves the right to make changes to the application examples at any time without notice. In case of discrepancies between the suggestions in the application examples and other Siemens publications such as catalogs, the content of the other documentation shall have precedence.

The Siemens terms of use (https://support.industry.siemens.com) shall also apply.

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens’ products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit https://www.siemens.com/industrialsecurity.

Siemens’ products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer’s exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at: https://www.siemens.com/industrialsecurity.

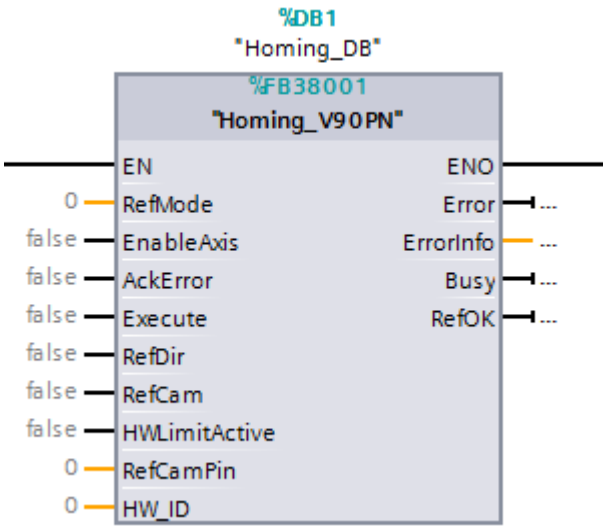
Table of contents

1 Function block “Homing_V90PN” (FB38001)

1.1 Description

The appropriate instance DB is automatically created with the integration of FB38001 (Homing_V90PN). Figure 1-1shows the function block interface.

Figure 1-1



It can be used in SIMATIC S7-1200/1500 CPUs.

Calling OBs

The block can be inserted alternatively in the following OBs:

Cyclic task: OB1

Cyclic interrupt OB: e.g. OB32

Called blocks

DPRD_DAT/SFC14

DPWR_DAT/SFC15

1.2 Function description – general

NOTICE	This function block works only with V90 PN drive and the standard telegram 111.

Input interface Homing_V90

The input interface consists of 9 inputs with various data formats.

When the function block is first configured, the inputs are set up with initial values.

Table 1-1

Input signal	Type	Default	Comments
RefMode (Reference mode)	Int	0	Homing via “set reference point” ... **= 2**: set reference point **= 7**: by moving the axis to reference cam (PLC) **= 8**: by moving the axis to reference cam (V90) **= 9**: by moving the axis to reference cam (PLC) with hardware limit switch as reversal point **= 10**: by moving the axis to reference cam (V90) with hardware limit switch as reversal point Active Homing with … **= 0**: reference cam (PLC) and encoder zero mark **= 1: referencing only on encoder zero mark** **= 3**: reference cam (V90) and encoder zero mark **= 4**: reference cam (PLC) with encoder zero mark and hardware limit switch as reversal point **= 5**: reference cam (V90) with encoder zero mark and hardware limit switch as reversal point **= 6**: hardware limit switch used as reference cam and encoder zero mark
EnableAxis	Bool	false	Enable the drive
AckError	Bool	false	Acknowledging errors
ExecuteMode	Bool	false	Execute the homing process
RefDirection	Bool	false	Select the start direction for automatic referencing “0” / “1” = start in positive / negative direction
RefCamInput	Bool	false	Reference cam signal
HWLimitEnable	Bool	false	Activate the hardware stop cams. “0” / “1” = deactivate / activate the stop cams
RefCamPin	Int	0	Definition for the drive digital input as reference cam: =1: DI1 is the reference cam signal =2: DI2 is the reference cam signal =3: DI3 is the reference cam signal =4: DI4 is the reference cam signal
HW_ID	HW_IO	0	Symbolic name or HW ID address on the SIMATIC S7-1200 and S71500

NOTICE	The RefCamPin input is only effective with the reference mode 3, 5, 8, 10.

Output interface Homing_V90

The output interface consists of 3 outputs with various data formats.

When the block is first configured, the outputs are set up with initial values.

Table 1-2 shows an overview of the output interface:

Table 1-2

Input signal	Type	Default value	Comments
Busy	BOOL	False	“1” = The selected operation is ongoing.
RefOk	Bool	false	“1” = Reference is successfully finished by the V90
Error	Bool	false	“1” = Error occurs for this function block
ErrorInfo	Word	16#0	Details of the error information

2 Task

2.1 Overview

Introduction

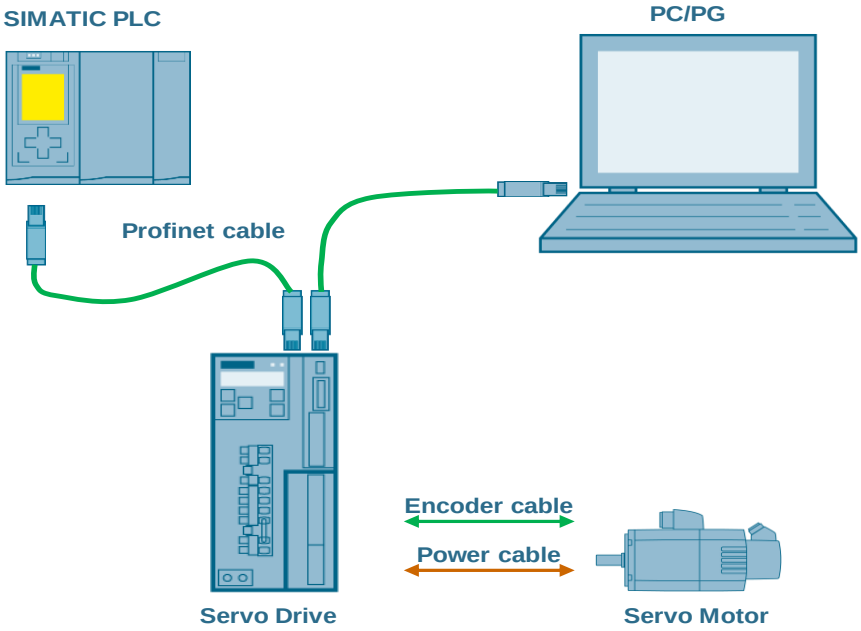
Basic positioner (EPos) is one of the two basic control modes for SINAMICS V90 Profinet version. In this manual, the basic application of the basic positioner (EPos) in SINAMICS V90 PN will be used with the standard telegram 111.

At the same time the homing function block will be used in a combination with the Easy_SINA_Pos block or the SINA_Pos block.

Overview of the automation task

The figure 2-1 provides an overview of the automation task.

Figure 2-1



2.1.1 Used Components

The application was generated with the following components:

Hardware components

Table 2-1

Component	No.	Article number	Note
SIMATIC S7-1500 CPU1511F 1-PN	1	6ES7511-1FK01-0AB0	V2.0
SINAMICS V90 PN 200V	1	6SL3210-5FB10-1UF0	0.4 kW
SIMOTICS S-1FL6 Li motor	1	1FL6024-2AF21-1AA1	0.4 kW

Standard software components

Table 2-2

Component	No.	Article number	Note
TIA Portal	1		V15
SINAMICS V-ASSISTANT	1		V1.05.00.00

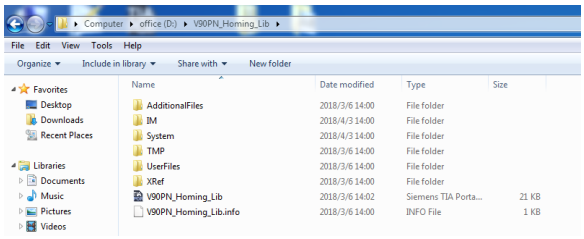
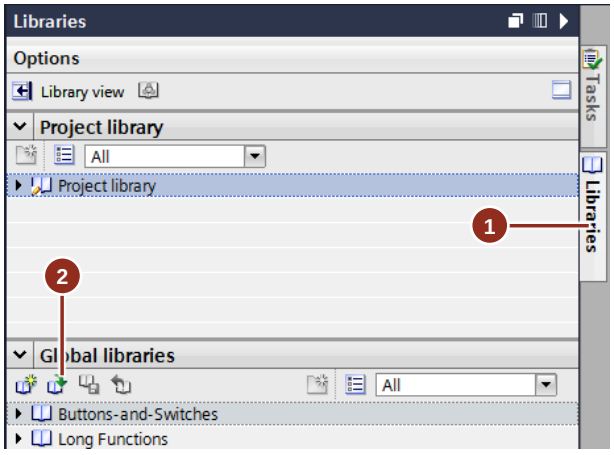
2.2 Operation of the application

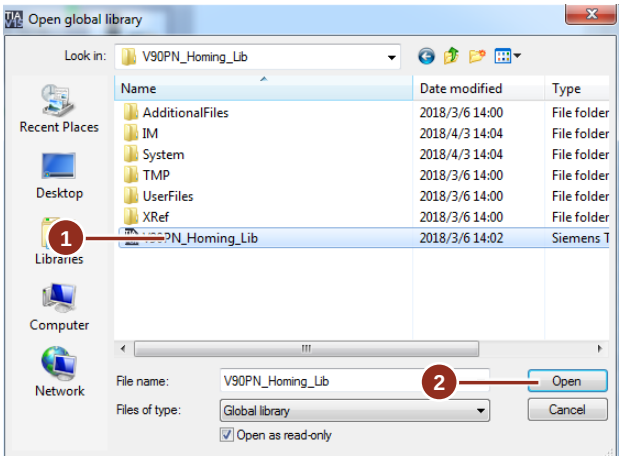
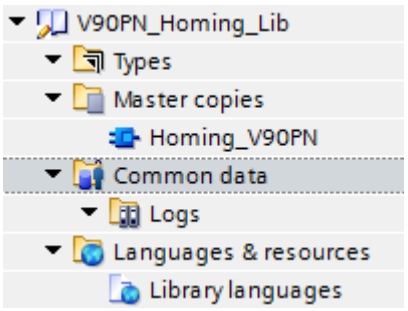
NOTICE	**It is assumed that you are already familiar with the SINAMICS V90 PN drive configuration with V_ASSISTANT.** **It is assumed that you are already familiar with the PLC project configuration with TIA Portal V15.** **It is assumed that you are already familiar with how to configure a function block to TIA project.** **The Homing function block can be downloaded from the following link:** **https://support.industry.siemens.com/cs/ww/en/view/109747655**

2.2.1 Configuration of an example project

The table 2-3 shows how to configure the project with the homing function block.

Table 2-3

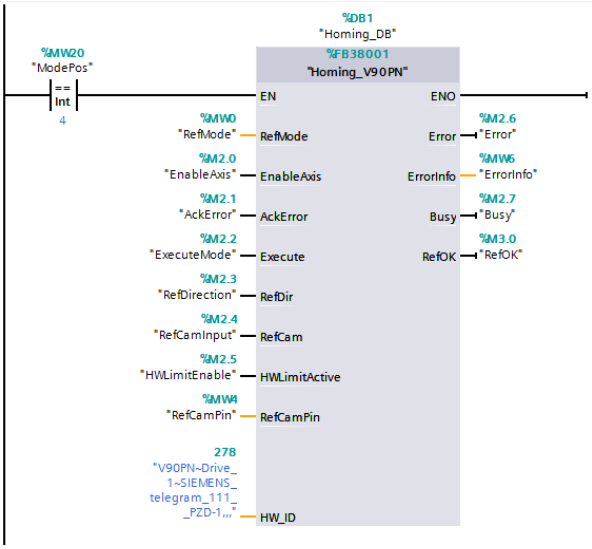
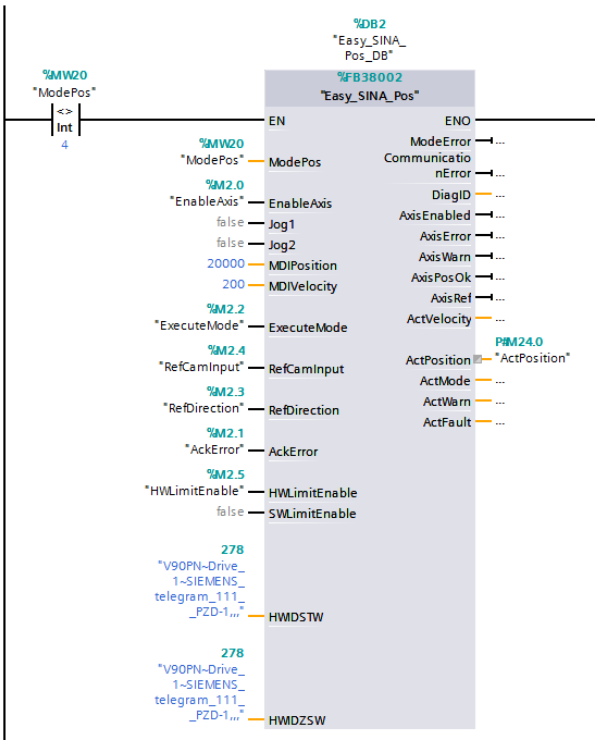
No.	Action	Remark
1.	Download the library from Siemens product and information pages and unzip the library to an arbitrary directory https://support.industry.siemens.com/cs/ww/en/view/109747655	
2.	Unzip the delivered library (inside of the *.zip file) into a self-defined folder	
3.	Open a TIA project and load this library (which contains the function block) to global libraries	

No.	Action	Remark
4.	Find the target function block in the “lib” folder and open it.	
5.	View of the installed libraries for S7-1X00	

2.2.2 Homing block with Easy_SINA_Pos block

Table 2-4 shows how to use the homing block in combination with the Easy_SINA_Pos block:

Table 2-4

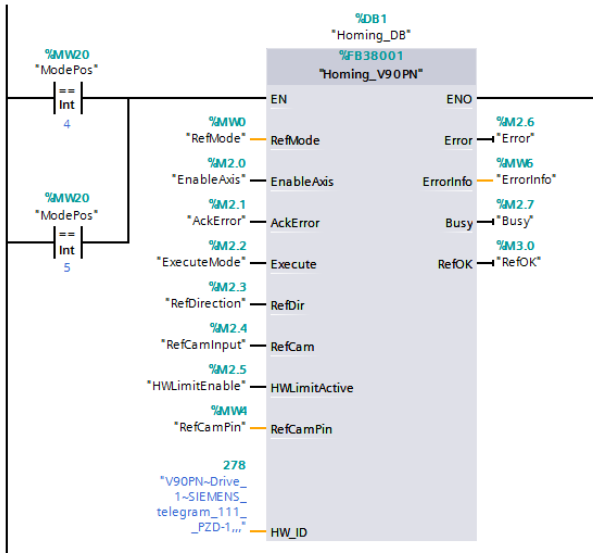
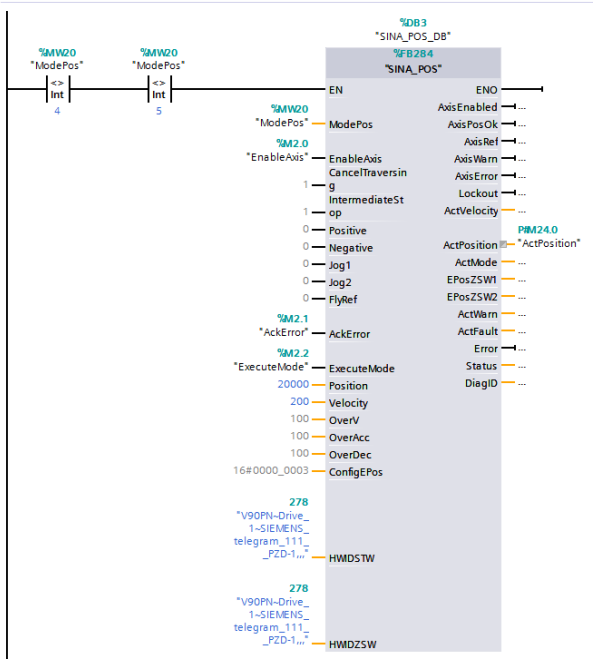
No.	Action	Remark
1	Program the homing block as the remark.	
2	Program the Easy_SINA_Pos block as the remark.	

NOTE In the realized PLC logic, using the reference mode to call FB38001 (Homing_V90 PN), and using other modes to call FB38002 (Easy_SINA_Pos).

2.2.3 Homing block with SINA_POS block

Table 2-5 shows how to use the homing block in combination with the SINA_POS block.

Table 2-5

No.	Action	Remark
1	Program the homing block as the remark.	
2	Program the SINA_POS block as the remark.	

NOTE In the realized PLC logic, using the reference mode to call FB38001 (Homing_V90 PN), and using other modes to call FB284 (SINA_POS).

3 Reference mode operations

3.1 Overview

SINAMICS V90PN drive's EPOS function supports telegram 7, 9, 110 and 111. It doesn't support the free telegram and BICO function to configure the drive. In this application, it's only discussed the homing application with telegram 111 in SINAMICS V90PN drive.

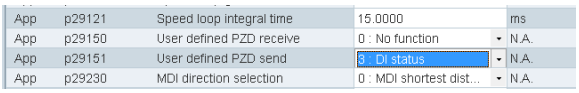
The table 3-1 shows the related control bits of telegram 111 used in this application.

Table 3-1

Item	Control bits	Function description
1.	STW1.0	ON/OFF1
2.	STE1.7	Acknowledge faults
3.	STW1.8	Jog1
4.	STW1.9	Jog2
5.	STW1.11	Start referencing
6.	POS_STW2.1	Set reference point
7.	POS_STW2.2	Reference cam
8.	POS_STW2.9	Start searching for the reference point direction
9.	POS_STW2.15	STOP cam activation

The table 3-2 shows the related status bits of telegram 111 used in this application.

Table 3-2

Item	Status bits	Function description
1.	ZSW1.0	Ready to start
2.	ZSW1.2	Drive enabled
3.	ZSW1.3	Drive fault
4.	POS_ZSW1.8	STOP cam minus active
5.	POS_ZSW1.9	STOP cam plus active
6.	POS_ZSW1.10	Jog active
7.	POS_ZSW1.11	Reference point approach
8.	Free word "User defined PZD send"	This word is used to read the drive digital input status To add the status of the digital inputs to the telegram use the V-Assistant: 

App	p29121	Speed loop integral time	15.0000	ms
App	p29150	User defined PZD receive	0 : No function	N.A.
App	p29151	User defined PZD send	3 : DI status	N.A.
App	p29230	MDI direction selection	0 : MDI shortest dist...	N.A.

NOTE Several reference modes are using the V90 digital input as reference cam inside of the function block "Homing_V90 PN". In this case it is necessary to add the status of the digital inputs to the telegram 111 (see table 3-2).

The table 3-3 shows the related parameters of SINAMICS V90PN drive used in this application.

Table 3-3

Item	Parameters	Function description
1.	P2605	Speed of searching reference cam
2.	P2606	Max. distance for searching reference cam
3.	P2608	Speed of searching zero mark
4.	P2609	Max. distance for searching zero mark
5.	P2611	Speed of approaching reference point
6.	P2599	Coordinate value of the reference point
7.	P2600	Offset
8.	P29240	Select referencing mode
9.	P29151	Set the function of free word

NOTE The reference mode set in P29240 is the characterization of the drive function. It is important to distinguish that this setup is an additional / different step to realize the programed reference modes set in the PLC program. The application is focusing on the PLC functionality.

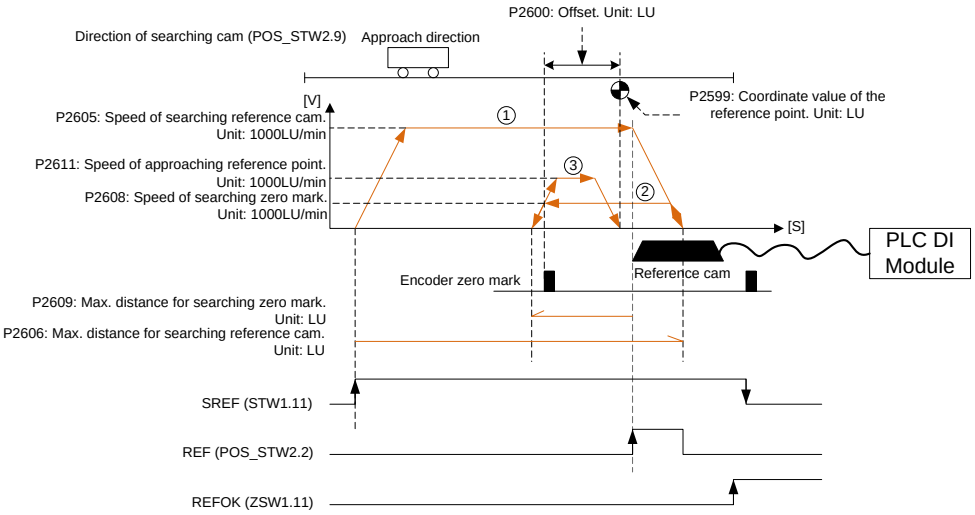
3.2 Standard reference modes for the FB “Homing_V90PN”

3.2.1 RefMode = 0 – Active Homing with reference cam (PLC) and encoder zero mark

In this mode the reference cam is connected to a PLC digital input and the homing process should to approach the reference cam and search the zero mark.

The figure 3-1 displays this process:

Figure 3-1



In this mode, the required setting of FB38001 input and the related V90 PN homing parameters is displayed in table 3-4. For the other setting of FB38001 showed in table 1-1 and V90 PN homing parameters showed in table 3-3 can be customized.

Table 3-4

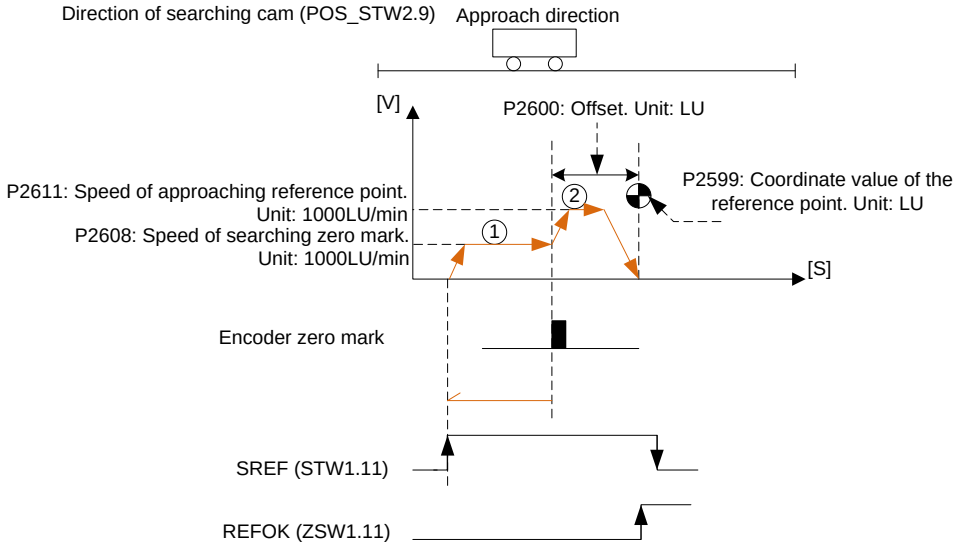
Item	FB Input / V90 Parameter	Value
1.	RefMode	=0
2.	RefCam	Connect to the digital input address of reference cam.
3.	RefCamPin	Not used.
4.	P29240	=1

3.2.2 RefMode = 1 – Active homing with referencing only on encoder zero mark

In this mode, there is no reference cam. The homing process only searches the zero mark.

The figure 3-2 displays this process:

Figure 3-2



In this mode, the required setting of FB38001 input and the related V90 PN homing parameters is displayed in table 3-5. For the other setting of FB38001 showed in table 1-1 and V90 PN homing parameters showed in table 3-3 can be customized.

Table 3-5

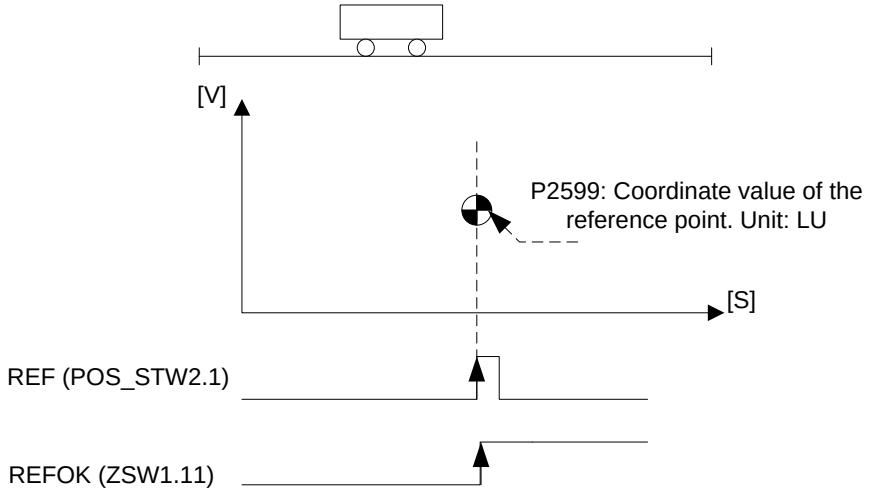
Item	Parameters	Value
1.	RefMode	=1
2.	RefCam	Not used.
3.	RefCamPin	Not used.
4.	P2605	Not used.
5.	P2606	Not used.
6.	P2609	Not used.
7.	P29240	=2

3.2.3 RefMode = 2 – Set reference point

In this mode, it can enable the referencing of the axis at an arbitrary position, and it is performed via the "set reference point" drive function.

The figure 3-3 displays this process:

Figure 3-3



In this mode, the required setting of FB38001 input and the related V90 PN homing parameters is displayed in table 3-6. For the other setting of FB38001 showed in table 1-1 and V90 PN homing parameters showed in table 3-3 can be customized.

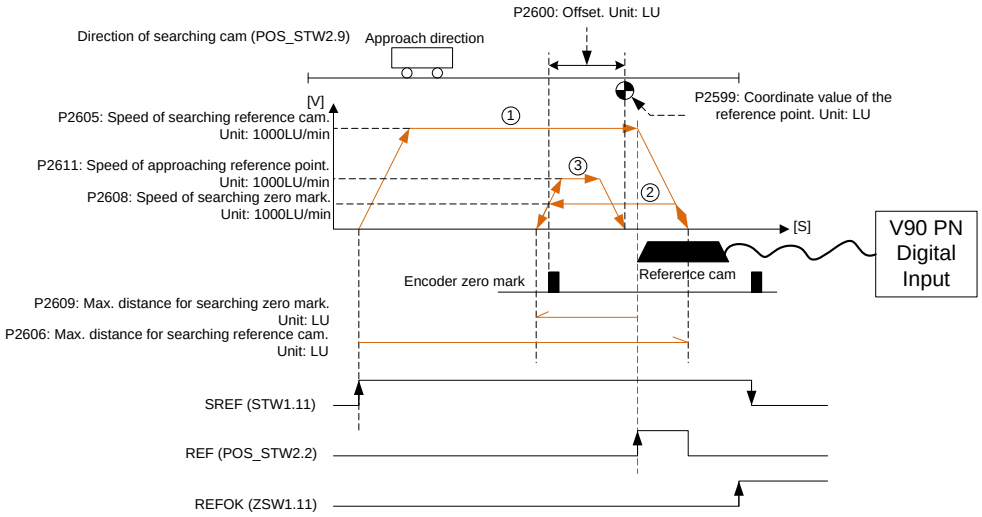
Table 3-6

Item	Parameters	Value
1.	RefMode	=2
2.	RefCam	Not used.
3.	RefCamPin	Not used.
4.	P2605	Not used.
5.	P2606	Not used.
6.	P2608	Not used.
7.	P2609	Not used.
8.	P2611	Not used.
9.	P2600	Not used.
10.	P29240	=0

3.2.4 RefMode = 3 – Active homing with reference cam (V90) and encoder zero mark

In this mode, the reference cam is connected to V90 PN digital input, and the homing process should to approach the reference cam and search the zero mark. The figure 3-4 displays this process.

Figure 3-4



In this mode, the required setting of FB38001 input and the related V90 PN homing parameters is displayed in table 3-7. For the other setting of FB38001 showed in table 1-1 and V90 PN homing parameters showed in table 3-3 can be customized.

Table 3-7

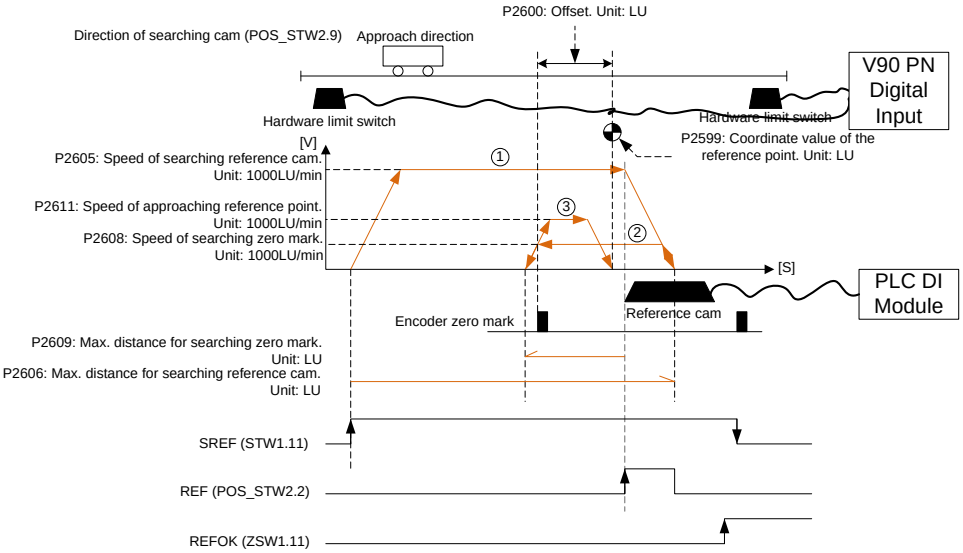
Item	FB Input / V90 Parameter	Value
1.	RefMode	=3
2.	RefCam	Not used.
3.	RefCamPin	The pin number which the reference cam connected to.
4.	P29240	=1
5.	P29151	=3

3.3 Smart reference modes for the FB “Homing_V90PN”

3.3.1 RefMode = 4 – Active homing with reference cam (PLC) with encoder zero mark and hardware limit switch as reversal point

In this mode, the reference cam is connected to PLC digital input, and the hardware limit switches are connected to the V90 PN digital input. The homing process should to approach the reference cam and search the zero mark. And when the motor reaches the hardware limit switch during homing, it will have the reverse function. The figure 3-5 displays this process.

Figure 3-5



In this mode, the required setting of FB38001 input and the related V90 PN homing parameters is displayed in table 3-8. For the other setting of FB38001 showed in table 1-1 and V90 PN homing parameters showed in table 3-3 can be customized.

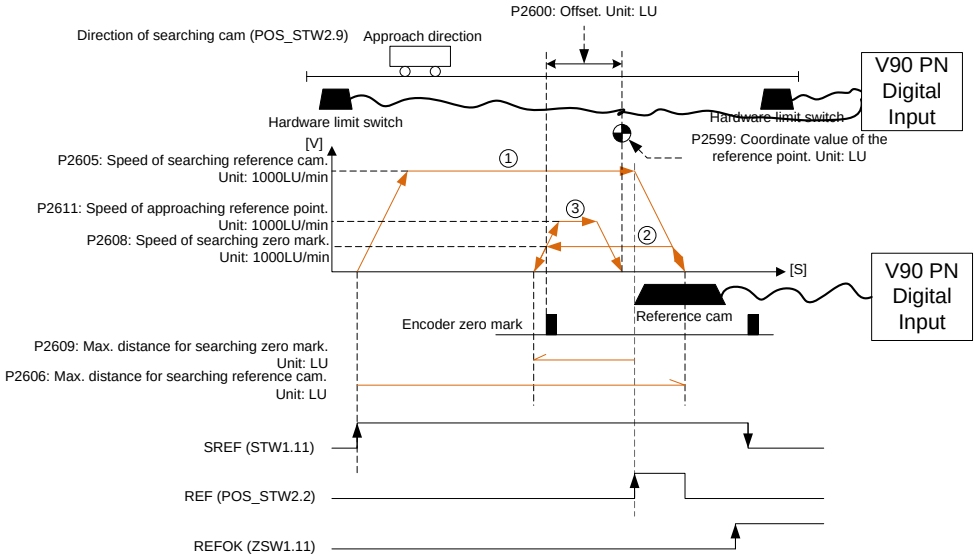
Table 3-8

Item	FB Input / V90 Parameter	Value
1.	RefMode	=4
2.	RefCam	Connect to the digital input address of reference cam.
3.	HWLimitActive	=1
4.	RefCamPin	Not used.
5.	P29240	=1

3.3.2 RefMode = 5 – Active homing with reference cam (V90) with encoder zero mark and hardware limit switch as reversal point

In this mode, the reference cam and the hardware limit switches are connected to the V90 PN digital input. The homing process should to approach the reference cam and search the zero mark. And when the motor reaches the hardware limit switch during homing, it will have the reverse function. The figure 3-6 displays this process.

Figure 3-6



In this mode, the required setting of FB38001 input and the related V90 PN homing parameters is displayed in table 3-9. For the other setting of FB38001 showed in table 1-1 and V90 PN homing parameters showed in table 3-3 can be customized.

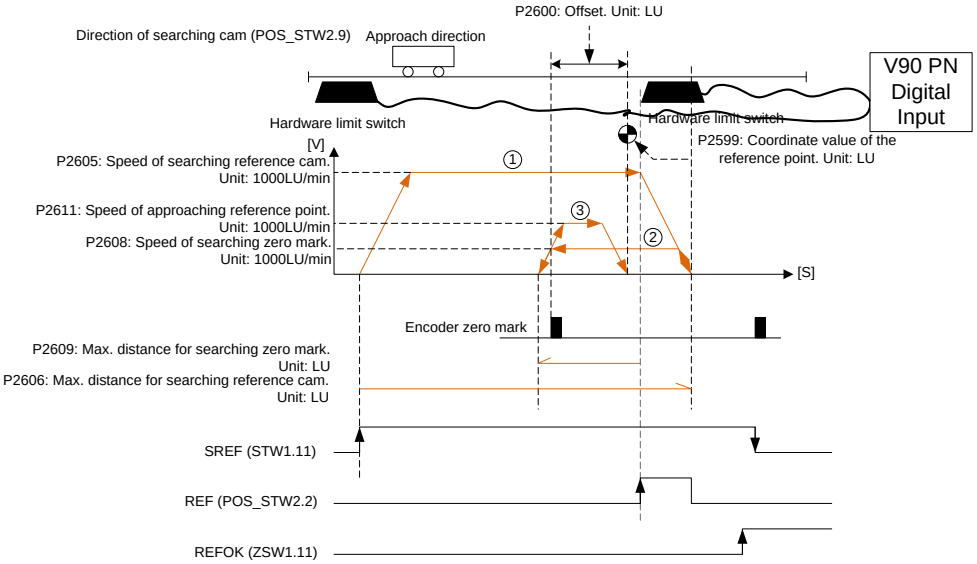
Table 3-9

Item	FB Input / V90 Parameter	Value
1.	RefMode	=5
2.	RefCam	Not used.
3.	HWLimitActive	=1
4.	RefCamPin	The pin number which the reference cam connected to.
5.	P29240	=1
6.	P29151	=3

3.3.3 RefMode = 6 – Active Homing with hardware limit switch used as reference cam and encoder zero mark

In this mode, it will use the hardware limit switch as the reference cam. The homing process should to approach the reference cam and search the zero mark. The figure 3-7 displays this process.

Figure 3-7



In this mode, the required setting of FB38001 input and the related V90 PN homing parameters are displayed in table 3-10. For the other setting of FB38001 showed in table 1-1 and V90 PN homing parameters showed in table 3-3 can be customized.

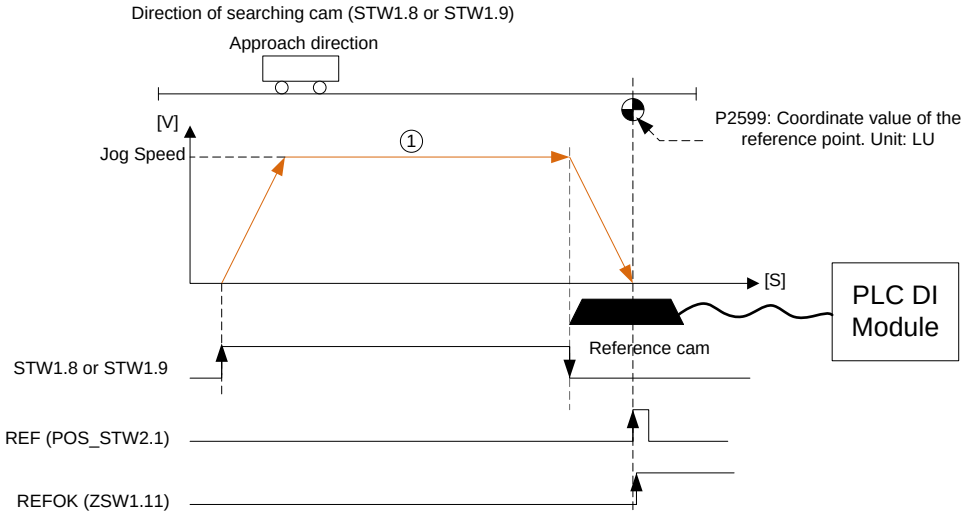
Table 3-10

Item	FB Input / V90 Parameter	Value
1.	RefMode	=6
2.	RefCam	Not used.
3.	HWLimitActive	=1
4.	RefCamPin	The pin number which the related hardware limit switch used for reference cam connected to.
5.	P29240	=1
6.	P29151	=3

3.3.4 RefMode = 7 – Homing via “Set reference point” by moving the axis to reference cam (PLC)

In this mode, the reference cam is connected to PLC digital input, and the homing process only approach the reference cam. The figure 3-8 displays this process.

Figure 3-8



In this mode, the required setting of FB38001 input and the related V90 PN homing parameters are displayed in table 3-11. For the other setting of FB38001 showed in table 1-1 and V90 PN homing parameters showed in table 3-3 can be customized.

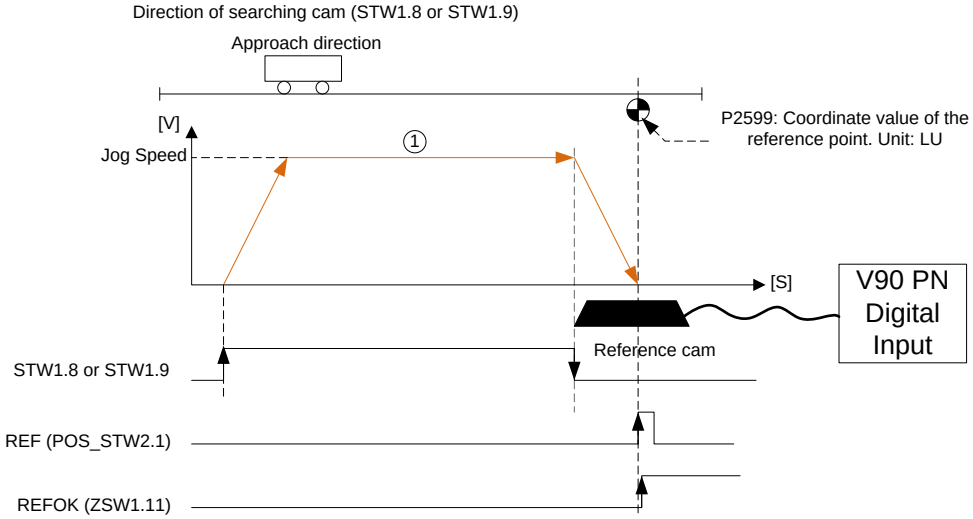
Table 3-11

Item	FB Input / V90 Parameter	Value
1.	RefMode	=7
2.	RefCam	Connect to the digital input address of reference cam.
3.	RefCamPin	Not used.
4.	P2605	Not used.
5.	P2606	Not used.
6.	P2608	Not used.
7.	P2609	Not used.
8.	P2611	Not used.
9.	P2600	Not used.
10.	P29240	=0

3.3.5 RefMode = 8 – Homing via “Set reference point” by moving the axis to reference cam (V90)

In this mode, the reference cam is connected to V90 PN digital input, and the homing process only approach the reference cam. The figure 3-9 displays this process.

Figure 3-9



In this mode, the required setting of FB38001 input and the related V90 PN homing parameters are displayed in table 3-12. For the other setting of FB38001 showed in table 1-1 and V90 PN homing parameters showed in table 3-3 can be customized.

Table 3-12

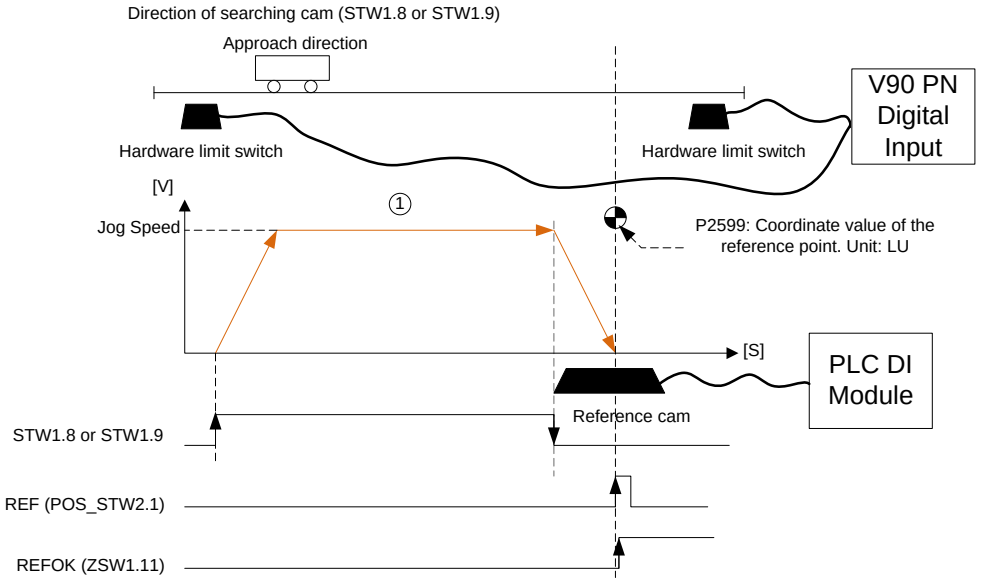
Item	FB Input / V90 Parameter	Value
1.	RefMode	=8
2.	RefCam	Not used.
3.	RefCamPin	The pin number which the related hardware limit switch used for reference cam connected to.
4.	P2605	Not used.
5.	P2606	Not used.
6.	P2608	Not used.
7.	P2609	Not used.
8.	P2611	Not used.
9.	P2600	Not used.
10.	P29240	=0
11.	P29151	=3

3.3.6 RefMode = 9 – Homing via “Set reference point” by moving the axis to reference cam (PLC) with hardware limit switch as reversal point

In this mode, the reference cam is connected to PLC digital input, and the hardware limit switches are connected to the V90 PN digital input. The homing process only approaches the reference cam. And when the motor reaches the hardware limit switch during homing, it will have the reverse function.

The figure 3-10 displays this process.

Figure 3-10



In this mode, the required setting of FB38001 input and the related V90 PN homing parameters is displayed in table 3-13. For the other setting of FB38001 showed in table 1-1 and V90 PN homing parameters showed in table 3-3 can be customized.

Table 3-13

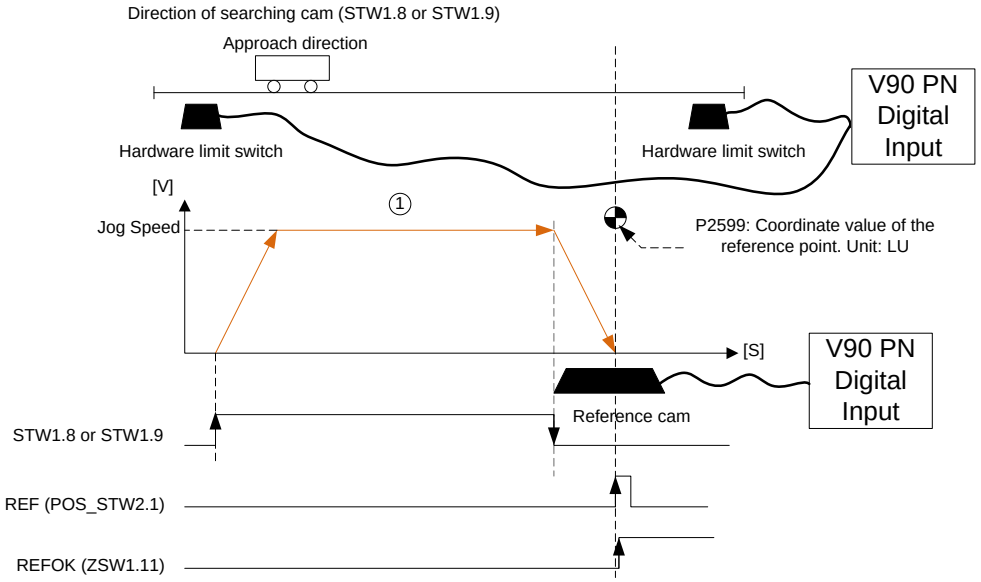
Item	FB Input / V90 Parameter	Value
1.	RefMode	=9
2.	RefCam	Connect to the digital input address of reference cam.
3.	HWLimitActive	=1
4.	RefCamPin	Not used.
5.	P2605	Not used.
6.	P2606	Not used.
7.	P2608	Not used.
8.	P2609	Not used.
9.	P2611	Not used.
10.	P2600	Not used.
11.	P29240	=0

3.3.7 RefMode = 10 – Homing via “Set reference point” by moving the axis to reference cam (V90) with hardware limit switch as reversal point

In this mode, the reference cam is connected to V90 PN digital input, and the hardware limit switches are connected to the V90 PN digital input. The homing process only approaches the reference cam. And when the motor reaches the hardware limit switch during homing, it will have the reverse function.

The figure 3-11 displays this process.

Figure 3-11



In this mode, the required setting of FB38001 input and the related V90 PN homing parameters is displayed in table 3-14. For the other setting of FB38001 showed in table 1-1 and V90 PN homing parameters showed in table 3-3 can be customized.

Table 3-14

Item	FB Input / V90 Parameter	Value
1.	RefMode	=10
2.	RefCam	Not used.
3.	HWLimitActive	=1
4.	RefCamPin	The pin number which the reference cam connected to.
5.	P2605	Not used.
6.	P2606	Not used.
7.	P2608	Not used.
8.	P2609	Not used.
9.	P2611	Not used.
10.	P2600	Not used.
11.	P29240	=0
12.	P29151	=3

4 Related literature

Table 4-1

	Topic
1.	Siemens Industry Online Support http://support.industry.siemens.com
2.	Download page of this entry https://support.industry.siemens.com/cs/ww/en/view/109747655
3.	

5 Contact

Siemens Ltd., China
DF M3-BF GMC

No. 18 Siemens Road
Jiangning Development Zone
Nanjing, 211100
China
mailto: mc_gmc_mp_asia.cn@siemens.com

6 History

Table 6-1

Version	Date	Modifications
V1.0	07/2018	First version