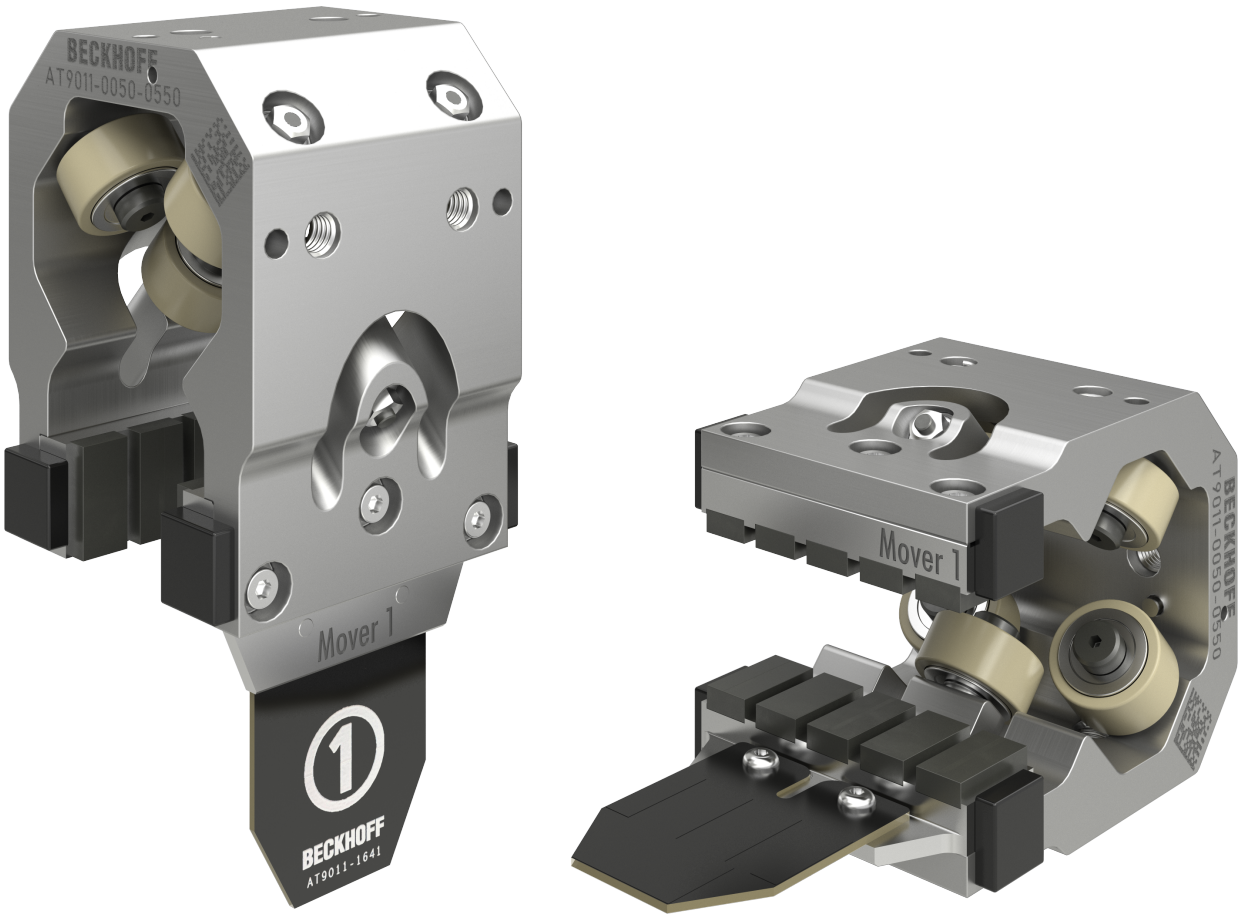

Functional description Mover 1

Version: 1.0
Date: 10.2018

BECKHOFF

Table of contents

1 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.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without prior announcement.
No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents:
EP1590927, EP1789857, DE102004044764, DE102007017835
with corresponding applications or registrations in various other countries.

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1.1 Staff qualification

The technical personnel must have knowledge of drive technology and electrical systems and must also know how to work safely on electrical equipment and machines. It is mandatory to use the documentation published at the respective time of each installation and commissioning.

This also includes:
- Work preparation
- Securing of the working environment (e.g. securing the control cabinet against being switched on again)

The technical personnel must be familiar with the current and necessary standards and directives for the automation and drive environment.

1.2 Description of symbols

Various symbols are used for a clear arrangement:

> The open triangle indicates an action that should be taken

• The bullet point indicates an enumeration

[…] The square parentheses indicate cross-references to other text passages in the document

+++ The three plus signs indicate accessories or components that are available in different versions

Pictograms

Pictograms are used to identify important text passages:

⚠ DANGER

The warning triangle indicates warning notes. If they are ignored, the result will be:

Damage and/or serious injuries

Fatal injuries

In the documentation the warning notes are placed at points in the operating instructions where it is important that they be observed.

NOTE

Notes are used for important information on the product! If they are ignored, the result will be:

Malfunctions of the product

Damage to the product

Damage to the environment

Tip or pointer!

This sign indicates information, tips and notes for dealing with the product or the software.

cULus note!

This sign indicates information on the cULus approval.

cRUus note!

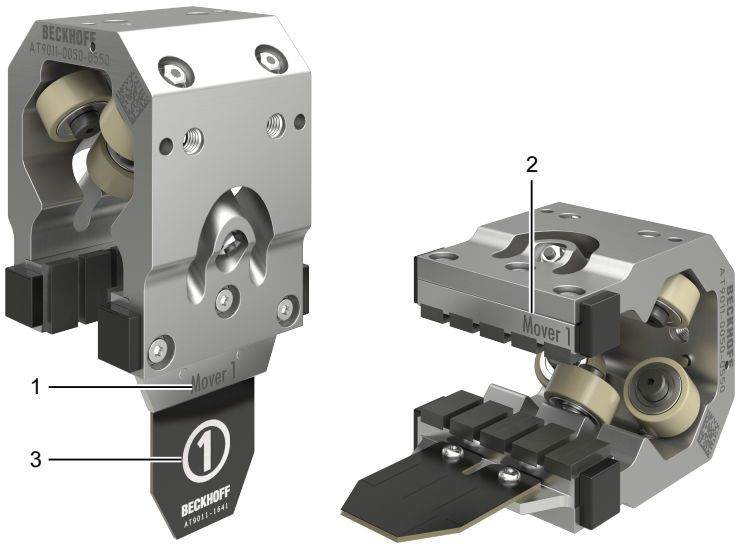
This sign indicates information on the cULus approval.

cULus Listed note!

This sign indicates information on the cULus Listed approval.

2 Mover 1 functionality

The XTS mover with the special magnetic plate set is outwardly recognizable by the engraving above the encoder flag and the printing on it as well as the engraving on the magnetic plate set.



Number	Explanation
1	“Mover 1” engraving above the encoder flag
2	“Mover 1” engraving on the magnetic plate set
3	“Mover 1” printing on the encoder flag

The purpose of the Mover 1 search is to identify a mover as a main mover and to distinguish it from the subsequent movers. This offers the advantage of a clear correlation between mover hardware and software axis.
If the Mover 1 search (MoverIdDetection) is triggered, all movers are moved.
The movement of the movers is thereby barely perceptible. The mover with the special magnetic plate set exhibits a different behavior due to the arrangement of these magnets and this is detected by the system. Afterwards, all movers are automatically resorted. The parameters of the individual movers can be retained when restarting the system.

48 V power supply required

The Mover 1 search requires a 48 V power supply so that the controller release can take place on the movers.

2.1 Product information

You have the option to purchase and use an XTS mover in a set with the special magnetic plate set. Alternatively, you can purchase the magnetic plate sets separately as accessories for the XTS mover. Product information and information on the necessary software can be found in the following tables:

XTS mover with “Mover 1” magnetic plate set

Name	Information
AT9011-0050-1550	Mover, 6 rollers (plastic coated), length 50 mm, 410 g, assembled with magnetic plate set AT9001-1550 and roller set ZX9011-0050
AT9011-0070-1550	Mover, 6 rollers (plastic coated), length 70 mm, 595 g, assembled with magnetic plate set AT9001-1550 and roller set ZX9011-0070
AT9012-0050-1550	Mover, 12 rollers (plastic coated), length 50 mm, 460 g, assembled with magnetic plate set AT9001-1550 and roller set ZX9012-0050

“Mover 1” magnetic plate sets

Name	Information
AT9001-1550	“Mover 1” magnetic plate set, 5-pole, length 50 mm, preassembled with 1.2 mm-thick encoder flag, to fit XTS standard movers
AT9001-1550-1840	“Mover 1” magnetic plate set, 5-pole, length 50 mm, preassembled with 1.8 mm-thick encoder flag, to fit external movers

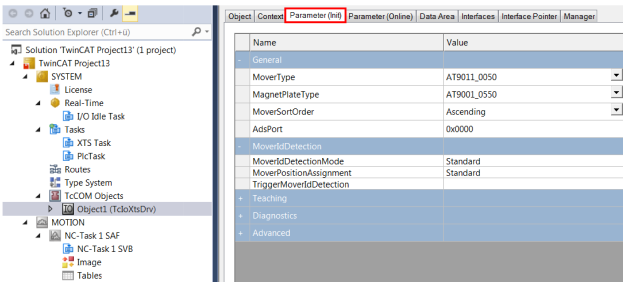
Software

Name	Information
TF5850-XTS-Technology	Version: 3.18.700 or higher

3 Application in the TcloXts object

The mover search across all movers is controlled via the TcloXts object. You have the option to apply general detection parameters and to trigger the Mover 1 search manually.

MoverIdDetectionMode



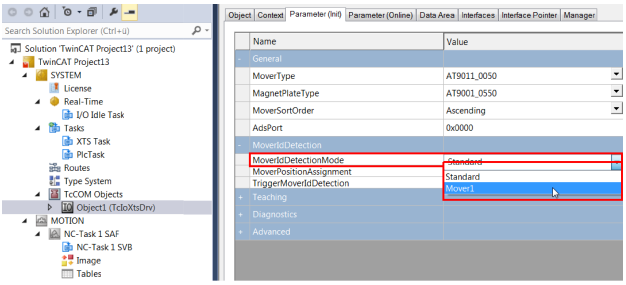
> Select the “Parameter(Init)” tab

⚠ DANGER

Select the “Mover 1” parameter

Select “Mover 1”; the system now expects only a mover with the certain magnetic plate set.

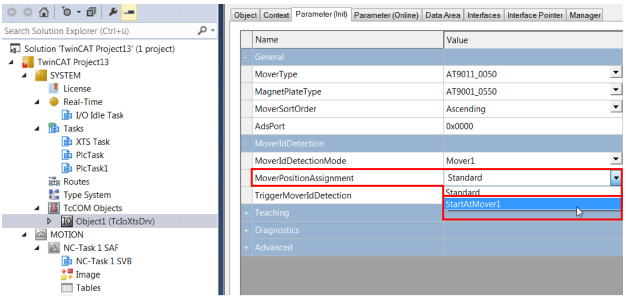
The mover will be incorrectly energized if you do not select the parameter. This leads to unforeseen movements of the mover. Unforeseen movements can lead to injuries to people and damage to tools and the machine.



> Select “Mover 1”

The system expects only a mover with other magnetic plates.

MoverPositionAssignment



> Select “StartAtMover1”

The mover has the lowest or highest position, dependent on the sorting order.

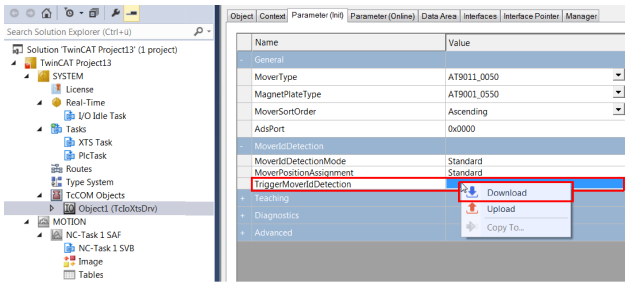
Example with a positive sorting order:
Mover 6 has the position 27 mm and Mover 1 the position 360 mm
The system length is then added to Mover 6: 360 mm + 3000 mm = 3360 mm

Note

After that the configuration must be activated and TwinCAT restarted.

> Restart TwinCAT

TriggerMoverIdDetection

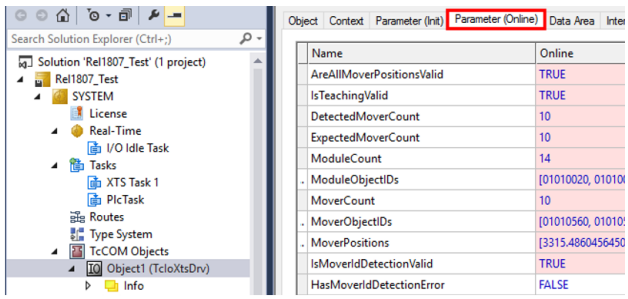


> Right-click in the “Value” column

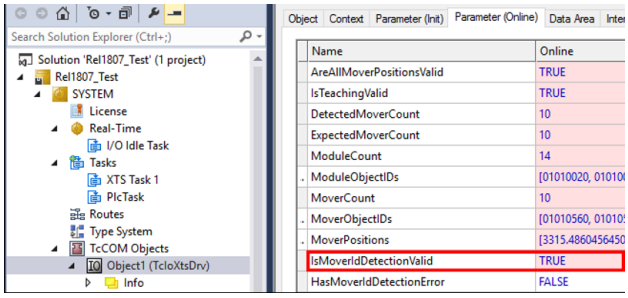
> Select the “Download” button

The Mover 1 search is now manually triggered. All movers are released.

IsMoverIdDetectionValid



> Select the “Parameter (Online)” tab



> Check the result

You get the result “TRUE”. Mover 1 was detected.

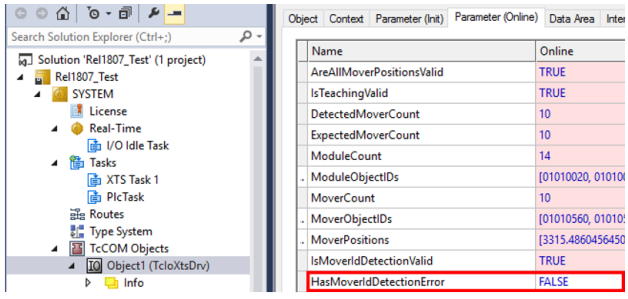
Note

If you get the result “FALSE”, this means that Mover 1 was not detected.

Possible causes:

- the mover search was not started
- You got a “TRUE” with “HasMoverDetectionError”

HasMoverIdDetectionError



> Check the result

You get the result “FALSE”. Mover 1 was detected. No errors occurred.

Note

If you get a “TRUE” in “HasMoverDetectionError”, this means that Mover 1 was not detected.

> Activate the Hidden Parameter “DetectionInfoMessage” [▶ 18]

> Adapt the parameter in the TcSoftDrive object [▶ 16]

> Execute the Mover search again

4 Use in the PLC

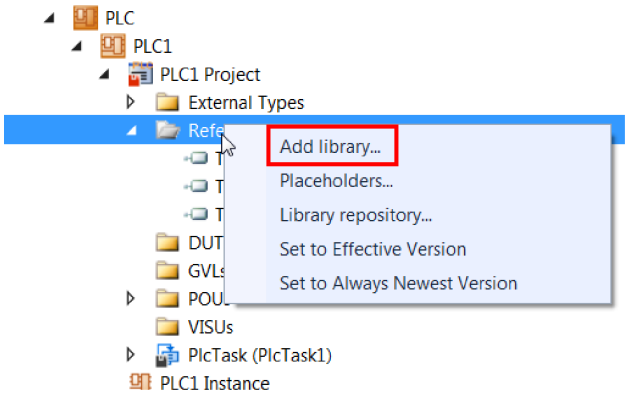
Via the PLC you have the possibility to trigger the Mover 1 search via two variants.

PLC variant I (trigger via Fb_XtsUnit)	PLC variant II (trigger via ADS-Write)
This variant can be used for the diagnosis of the XTS system. **Note** The call in the PLC requires computing time. If the computing time for the application proves to be a problem, use the PLC variant II.	This variant can be used if a dedicated diagnosis is available.

4.1 Add library

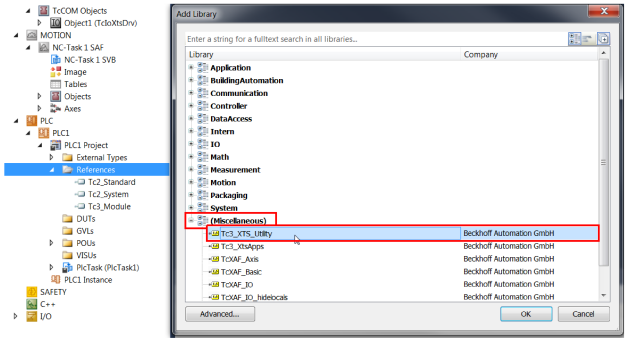
For the use of the PLC variant I (Trigger via Fb_XtsUnit) it is necessary to add the matching library:

Tc3_XTS_Utility library



> Right-click on “References” in the explorer

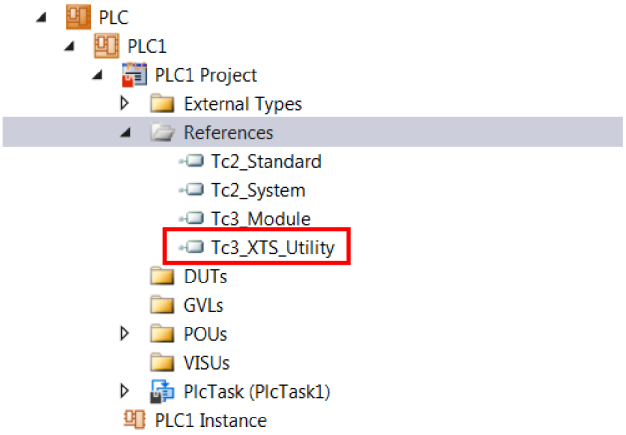
> Select the “Add library” button



> Select “(Miscellaneous)”

> Select the “Tc3_XTS_Utility” library

The library is added to the project.



> Check whether the library has been added to the project

After successful addition, the library appears under “References” in the Explorer.

Also see about this

- Hidden Parameters in the TcSoftDrive object [▶ 18]
- TcSoftDrive object [▶ 16]

4.2 PLC variant I (trigger via Fb_XtsUnit)

You have the option to trigger the Mover 1 search via variant I. The following example code is available to you for the search so that you can trigger the search automatically:

```
// Declaration Part
PROGRAM MAIN
VAR
     stMoverRef                      : ARRAY [1..cAxcnt] OF AXIS_REF;
     fbXtsUnit                       : FB_XtsUnit;
     bMoverIdDetectionError          : BOOL;
     bStartMoverIdDetection          : BOOL := TRUE;
     bMoverIdDetected                : BOOL;
END_VAR

// Programm Part
// Cyclic call up of the main block of the XtsUtility Library
fbXtsUnit( Axis := stMoverRef);
IF fbXtsUnit.stXtsUnit.stTcIoXtsDrv.stParameter.bAreAllMoverPositionsValid THEN

// Check whether the position detection of the movers has been completed.
// Then the Mover search can be started.
// Check whether the "MoverIdDetection" has already been stared:
   "bStartMoverIdDetection" is set to "False" after a single initiation.
// Check whether the "Mover1DetectionMode" has been activated in the TcXtsIo driver.
   If the Mover 1 search was not activated in the TcIoXts, then the activation of the
   "MoverIdDetection" skipped and "bStartMoverIdDetection" was set to "False".
     IF bStartMoverIdDetection
         AND fbXtsUnit.stXtsUnit.stTcIoXtsDrv.stParameter.eMoverIdDetectionMode
             = E_MoverIdDetectionMode.Mover1
         THEN
              fbXtsUnit.stXtsUnit.stTcIoXtsDrv.ipTcXtsIo.TriggerMoverIdDetection();
              bStartMoverIdDetection := FALSE;
         ELSE
              bStartMoverIdDetection := FALSE;
     END_IF
END_IF


// Check for error or success of "MoverIdDetection"
bMoverIdDetectionError := fbXtsUnit.stXtsUnit.stTcIoXtsDrv.stParameter.bHasMoverIdDetectionError;
bMoverIdDetected := fbXtsUnit.stXtsUnit.stTcIoXtsDrv.stParameter.bIsMoverIdDetectionValid;
```

4.3 PLC variant II (trigger via ADS-Write)

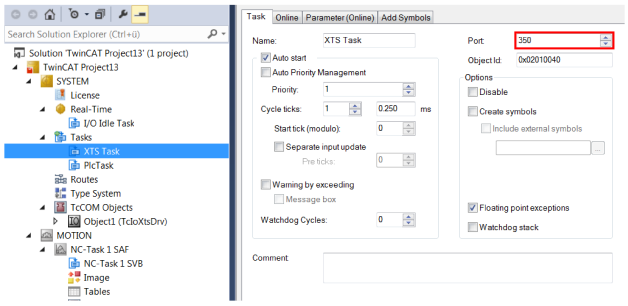
You have the option to trigger the Mover 1 search via variant II. The parameters of the TcloXts driver object can be accessed via the “ADSREAD” or “ADSWRITE” command. A function block is available to you in the Beckhoff InfoSys:

Link to the function block

For the parameterization you need the XTS-specific details, which are listed in the table:

Code block	Description
`PORT : T_AmsPort;`	TaskPort of the Xts_Task
`IDXGRP : UDINT;`	Object Id from the TcloXts driver object
`IDXOFFS : UDINT;`	PTCID of the parameter

TaskPort



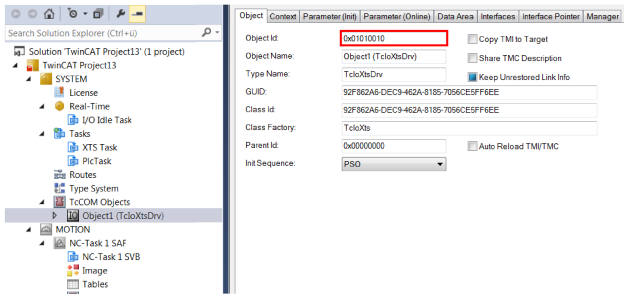
> Select the “XTS Task” under “Tasks” in the Solution Explorer

> Select the “Task” tab

> Read the value

The value must be “350”.

Object Id

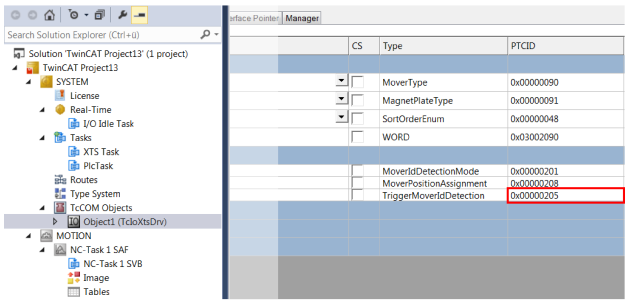


> Select the “Object1 (TcloXtsDrv)” driver under “TcCOM Objects” in the Solution Explorer

> Select the “Object” tab

> Read the value

PTCID



> Select the “Object1 (TcloXtsDrv)” driver under “TcCOM Objects” in the Solution Explorer

> Select the “Parameter(Init)” tab

> Read the values

4.4 Example: “Trigger MoverIdDetection”

An example of a “Trigger MoverIdDetection” is available to you here:

```
//Definition
VAR
    fbAdsWrite      : ADSWRITE;
END_VAR

    fbAdsWrite(
        NETID       := '',
        PORT        := 350,          // Taskport of the XTS-Task
        IDXGRP      := 16#01010010,  // Object Id
        IDXOFFS     := 16#205,       // PTDCID TriggerMoverIdDetection
        WRITE       := TRUE);
```

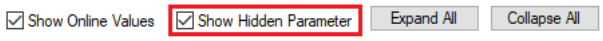
5 Advanced operation

You have the option to make further settings in the parameters for advanced operation. The standard parameters usually correspond to your XTS. The Mover 1 search can be started immediately. The search lasts a few seconds and is dependent on the number of movers and the distance between the individual movers.

If the parameters do not correspond to your system, change them in the TcloXts and TcSoftDrive object.

5.1 Hidden Parameters in the TcloXts object

For the advanced operation of the Mover 1 search you have the option to use “Hidden Parameters”. For example, you can change the time delay and distances.

	> Activate the “Show Hidden Parameters” checkbox to display the “Hidden Parameters”

Hidden Parameters	Description
DelayBetweenMoversInPack	Time delay [s] in the mover search between movers in the same mover pack
DelayBetweenMoverPacks	Time delay [s] in the mover search between movers in different mover packs
GapToDefineMoverPack	Distance [mm] between movers in order to define a new mover pack ***Note*** To prevent movers mechanical influencing one another, only one mover is triggered at any one time in a mover pack. On expiry of the search of a preceding mover in a pack and on expiry of the time “DelayBetweenMoversInPack”, the search for the next mover in the pack is started.

5.2 TcSoftDrive object

“MoverIdDetection” is controlled and executed for each mover axis via the TcSoftDrive object. You have the option via several parameters to carry out settings and the configuration of the detection procedure via the mover axis.

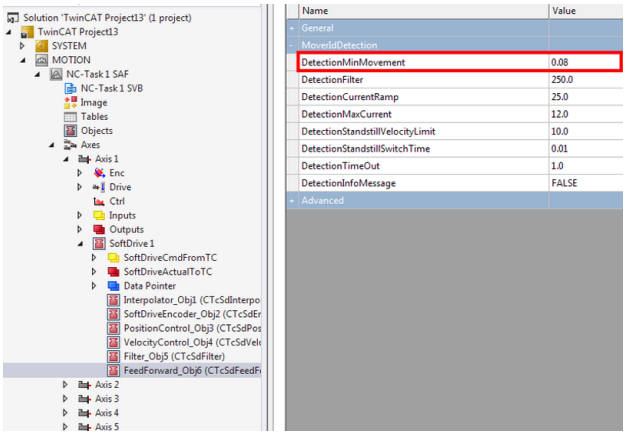
As an aid for the following steps, we provide you with standard parameters that have been tested for our Beckhoff movers.

Adjustment of the standard parameters with customer-specific movers

With customer-specific movers that differ from the tested Beckhoff movers in terms of rigidity, mass or some other deviating mechanical behavior, it may be necessary to adjust the standard parameters in order to optimize the mover search.

Name	Default	Min	Max	Unit	Tab
DetectionMinMovement	0.08	0.01	2.0	mm	Init
DetectionCurrentRamp	25	10	1000	mA/s	Init
DetectionFilter	250	0	5000	Hz	Init
DetectionMaxCurrent	12	0.5	13	A	Init

DetectionMinMovement

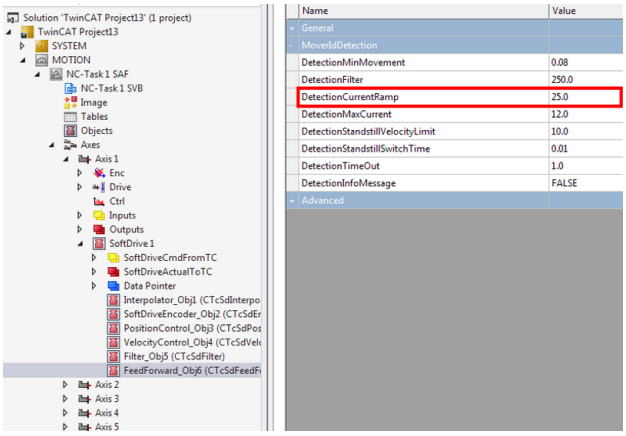


> Define the minimum position change during the mover search

Smaller value:
the change in position of the mover becomes smaller.

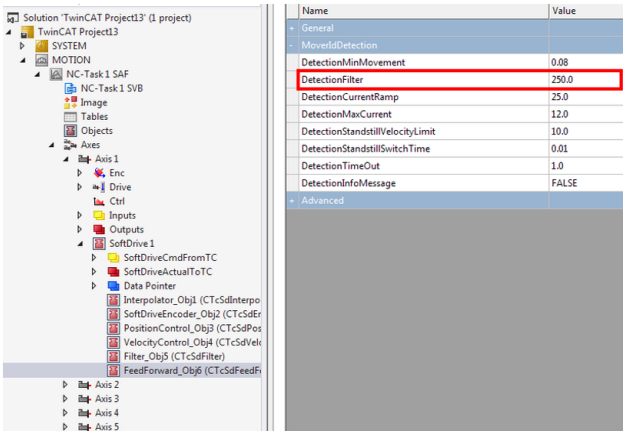
Larger value:
the change in position of the mover becomes larger and perhaps more visible.

DetectionCurrentRamp



> Define the increase in the mover detection current

DetectionFilter



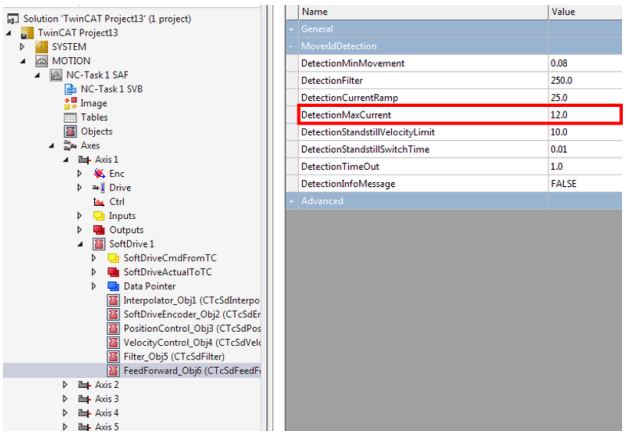
> Define filter for the change in current

Jerk for mover is limited.

Smaller value:
The mover search becomes gentler, because the current is not built up as fast.

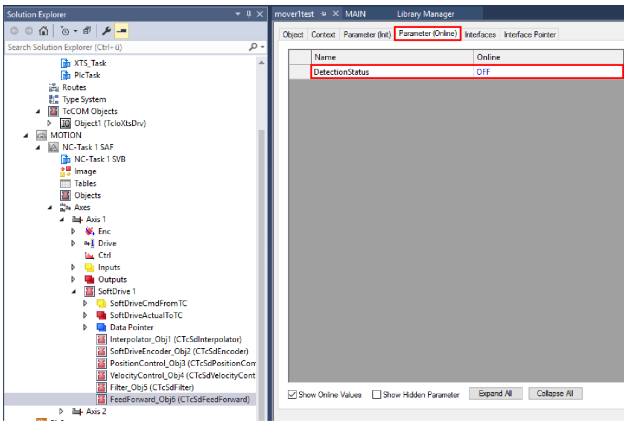
Larger value:
The current is built up more quickly; the mover search takes place more jerkily.

DetectionMaxCurrent



> Define the limit for the mover detection current

DetectionStatus



> Select the “Parameter (Online)” tab

> Check the result

You get the possible results:

0 = OFF
(Mover 1 search is not used)

1 = ACTIVE
(Mover 1 search is running)

2 = ERROR
(Mover 1 search has failed)

3 = FOUND_STANDARD
(the standard plate set was found for a certain mover)

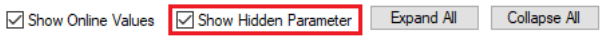
4 = FOUND_Mover1
(the Mover 1 plate set was found for a certain mover)

5.3 Hidden Parameters in the TcSoftDrive object

For the advanced operation and configuration of the detection procedure you have the option to use “Hidden Parameters”. For example, you can adjust various waiting times.

We provide you with standard parameters as an aid for the following steps:

Name	Default	Min	Max	Unit	Tab
DetectionInfoMessage	FALSE	FALSE	TRUE	--	Init
DetectionStandStillVelocityLimit	10	1	1000	mm/s	Init
DetectionStandStillSwitchTime	0.01	0.00	1.0	s	Init
DetectionTimeOut	2	0	10	s	Init

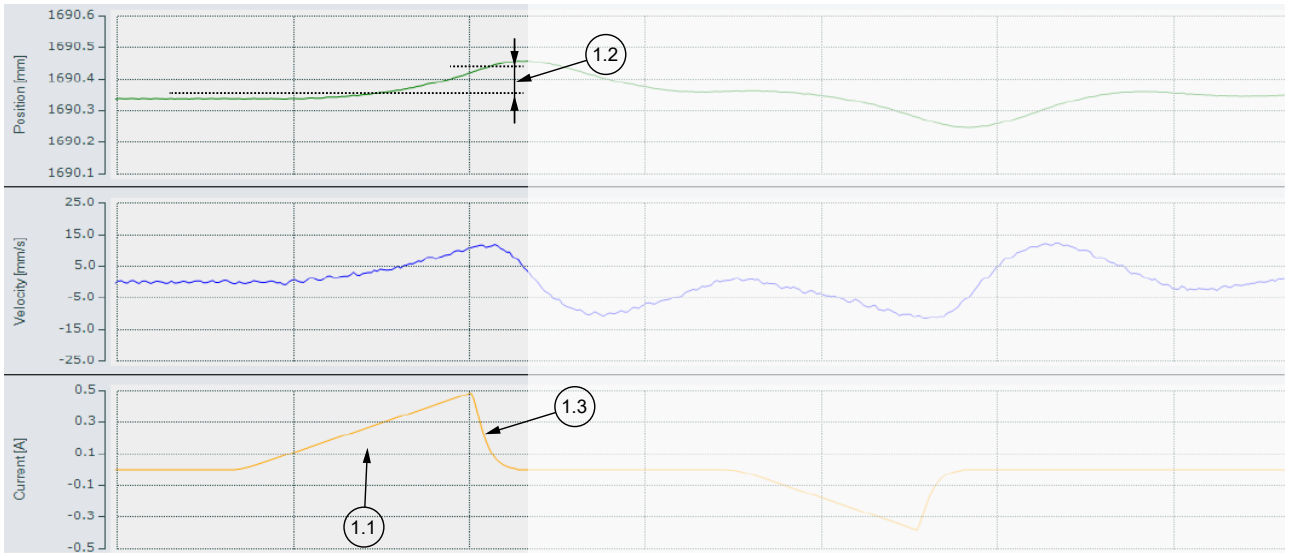
	> Activate the “Show Hidden Parameters” checkbox to display the “Hidden Parameters”

Hidden Parameters	Description
DetectionInfoMessage	On activation: Messages in the TwinCAT display window
DetectionStandstillVelocityLimit	Definition of the maximum speed for the standstill monitoring. **Small value:** The search changes to the next phase later. **Large value:** The search changes to the next phase earlier.
DetectionStandstillSwitchTime	Time during which the mover's velocity must lie below the “DetectionStandstillVelocityLimit” Small value: Mover search is accelerated Large value: Mover search is decelerated
DetectionTimeOut	Total timeout for the mover search ***Note*** An error occurs if this time is reached. Possible reasons include: • Too little movement due to too small a value in “DetectionMaxCurrent” • Missing 48 V power supply • Too large a value in “DetectionMaxMovement” • Too small a value in “DetectionMinCurrent” You should always be able to achieve the “DetectionMinMovement” with the standard parameter “DetectionMaxCurrent”.

6 Detection phases with effect of the parameters

In the following illustrations a Mover 1 search is shown as an example with the standard parameters.
The following phases are described:

Phase 1 – setting of the first current vector

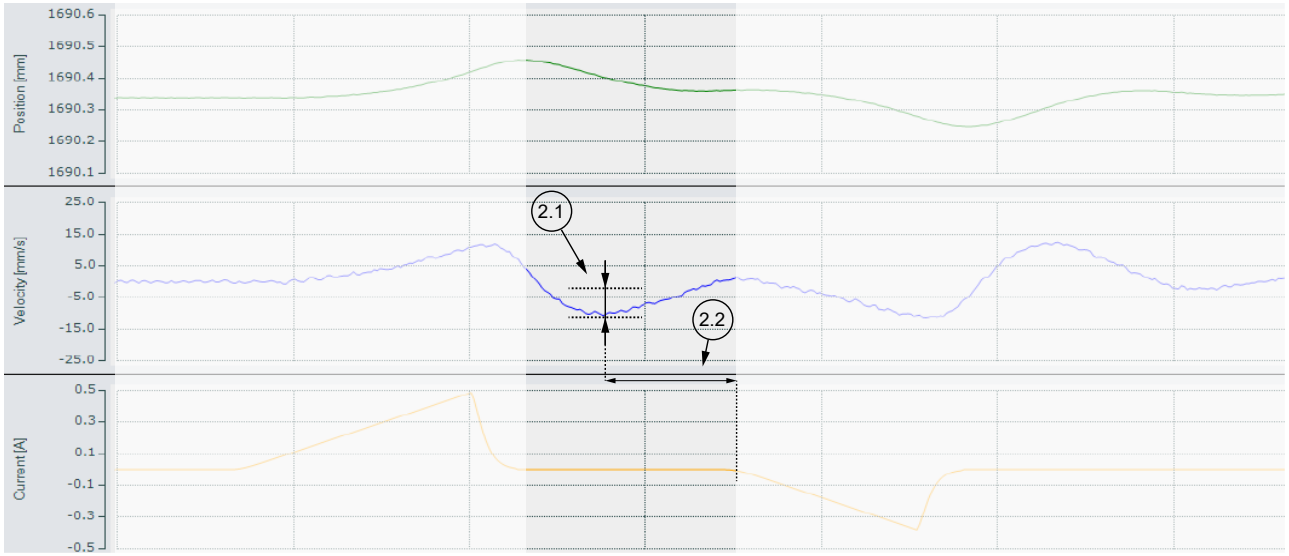


1.1 The absolute value of the current vector is increased in accordance with the parameter “DetectionCurrentRamp”.

1.2 The movement is monitored until the value of the “DetectionMinMovement” parameter is reached.

1.3 The current is decreased via a filter, defined by the “DetectionFilter” parameter.

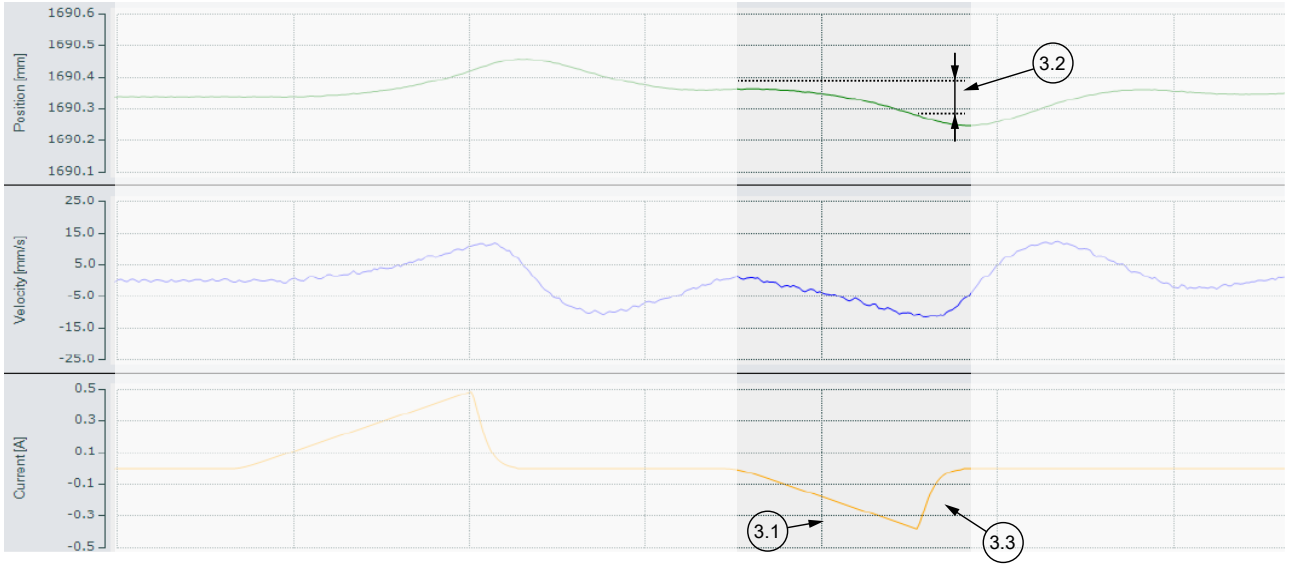
Phase 2 – wait until the mover comes to a standstill again



2.1 Wait until the velocity is smaller than the limit value set with the parameter “DetectionStandstillVelocityLimit”.

2.2 The velocity must lie continuously below the limit velocity for the time set with the parameter “DetectionStandstillSwitchTime”.

Phase 3 – set a second current vector in the opposite direction

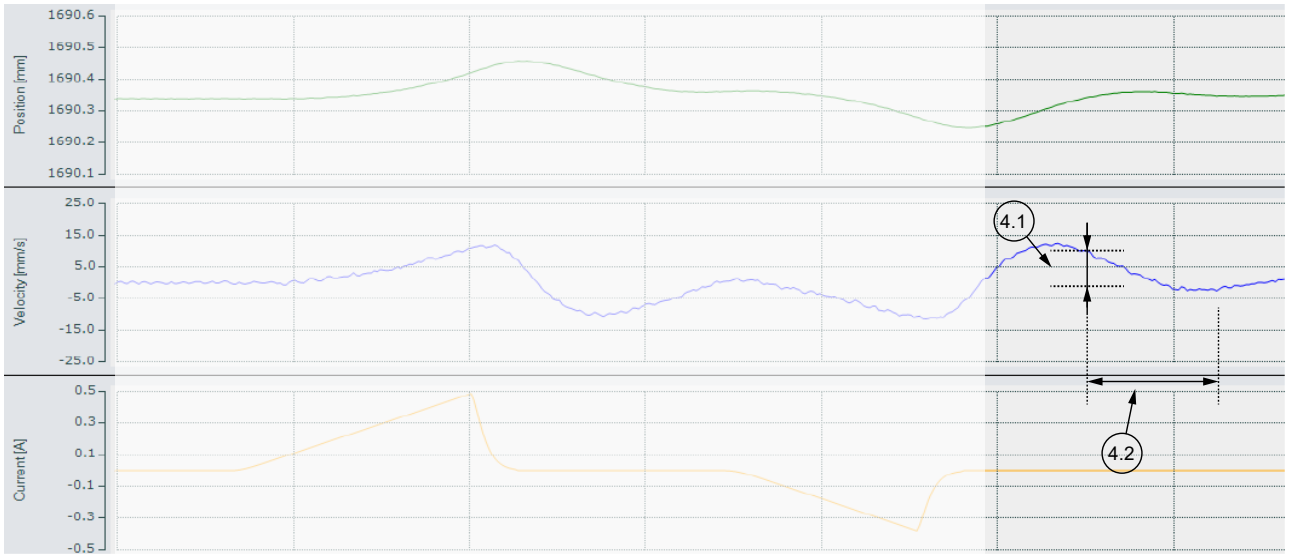


3.1 The absolute value of the present vector is increased in accordance with the parameter “DetectionCurrentRamp”.

3.2 The movement is monitored until the value of the “DetectionMinMovement” parameter is reached.

3.3 The current is decreased via a filter, defined by the “DetectionFilter” parameter.

Phase 4 – wait until the mover comes to a standstill again



4.1 Wait until the velocity is smaller than the limit value set with the parameter “DetectionStandstillVelocityLimit”.

4.2 The velocity must lie continuously below the limit velocity for the time set with the parameter “DetectionStandstillSwitchTime”.