

EtherCAT CiA402 Profile Interface

Manual



**Documentation of the EtherCAT CiA402 Interface of the
following Drives:**

- **F1150-DS-UC-3S**
- **F1050-DS-HC-0S**
- **I1050-DS-HC-0S**

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1 System overview

EtherCAT is the open real-time Ethernet network originally developed by Beckhoff. The LinMot act as Slave in this network and is implemented with the standard ASIC ET1100 from Beckhoff. With the CiA402 Protocol it is possible to use the drive profile functionality over the EtherCAT bus.

For further information on the EtherCAT fieldbus please visit:

<http://www.ethercat.org/>

1.1 References

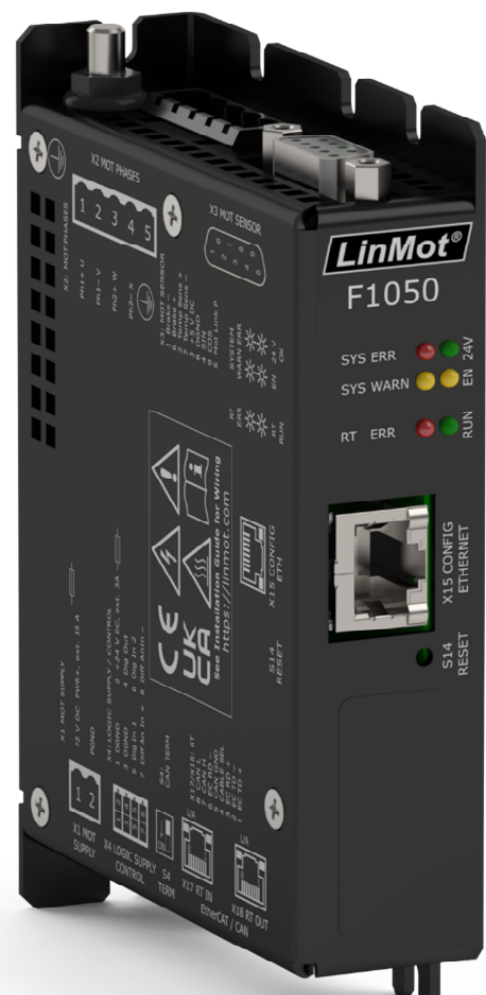
All user manuals are distributed with the LinMot-Talk software the newest versions can be downloaded from the LinMot homepage in the download section.

Ref	Title	Source
1	User Manual Motion Control SW	www.linmot.com
2	LinMot Drive Configuration over Fieldbus Interfaces SG5	www.linmot.com

1.2 Connecting In and Out



Attention: In the EtherCAT the cabling is directed due topology support, so In and Out is different! The real time Ethernet RJ45 connector X17 is the input and the real time RJ45 connector X18 is the output.



2 Setup in the PLC

In the following steps the integration of a LinMot EtherCAT Sercos Servo Drive in the PLC is described. In the example a Beckhoff master PLC is used. The easiest way is the online configuration when the device is connected to the EtherCAT network.

2.1 Copy Device Description File

The LinMot Servo Drive is described with *.xml device description file distributed with the LinMot-Talk software. This file is only used when offline configuration is desired.

Copy this file to PLC so it can access it.

Example Source path of EtherCAT Device description file:

```
C:\Programme\LinMot\LinMot-Talk 6.5 Build  
20160205\Firmware\Interfaces\EtherCAT\XML\NTIL_CiA402_Servos_V1_8r2.xml
```

Example Destination path of EtherCAT Device description file:

TwinCAT 2:

```
C:\TwinCAT\Io\EtherCAT\ NTIL_CiA402_Servos_V1_8r2.xml
```

TwinCAT 3:

```
C:\TwinCAT\3.1\Config\Io\EtherCAT\ NTIL_CiA402_Servos_V1_8r2.xml
```

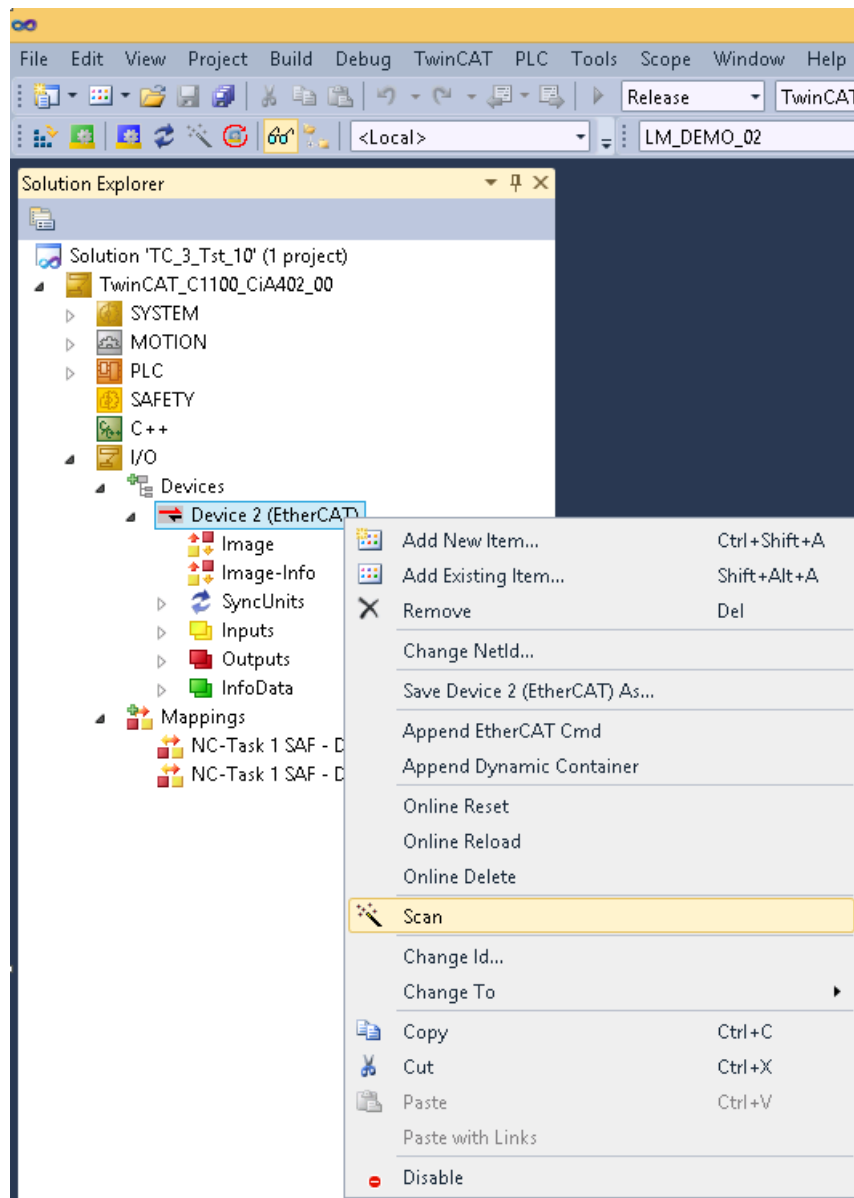
Omron:

```
C:\OMRON\Sysmac Studio\IODeviceProfiles\EsiFiles\UserEsiFiles\ NTIL_CiA402_Servos_V1_8r2.xml
```

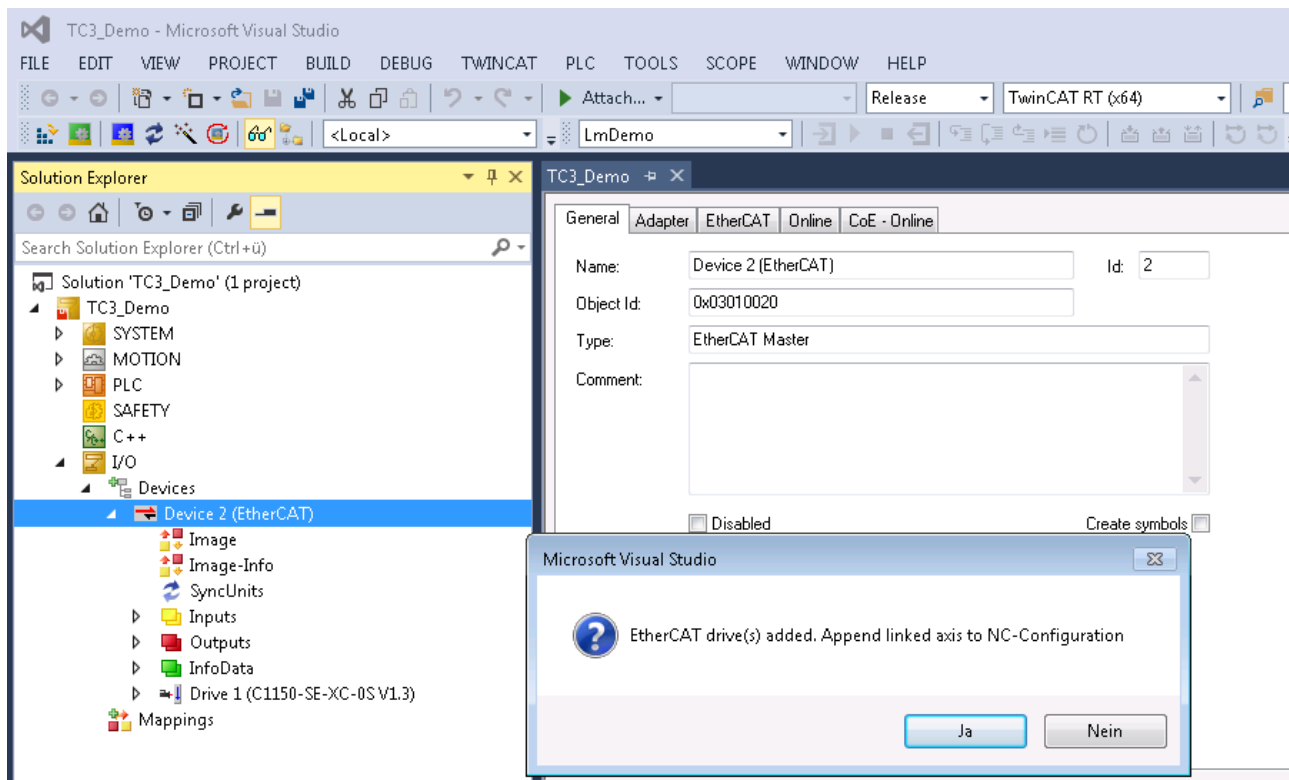
If this is done the PLC should recognize the corresponding LinMot drives on the EtherCAT fieldbus automatically.

2.2 Scan the EtherCAT slave devices

Connect the EtherCAT LinMot SoE Servo Drive to the EtherCAT-Master and power on the signal supply. Then scan for the connected devices in the System Manager: Please note that below each images you can find the explanation of the image

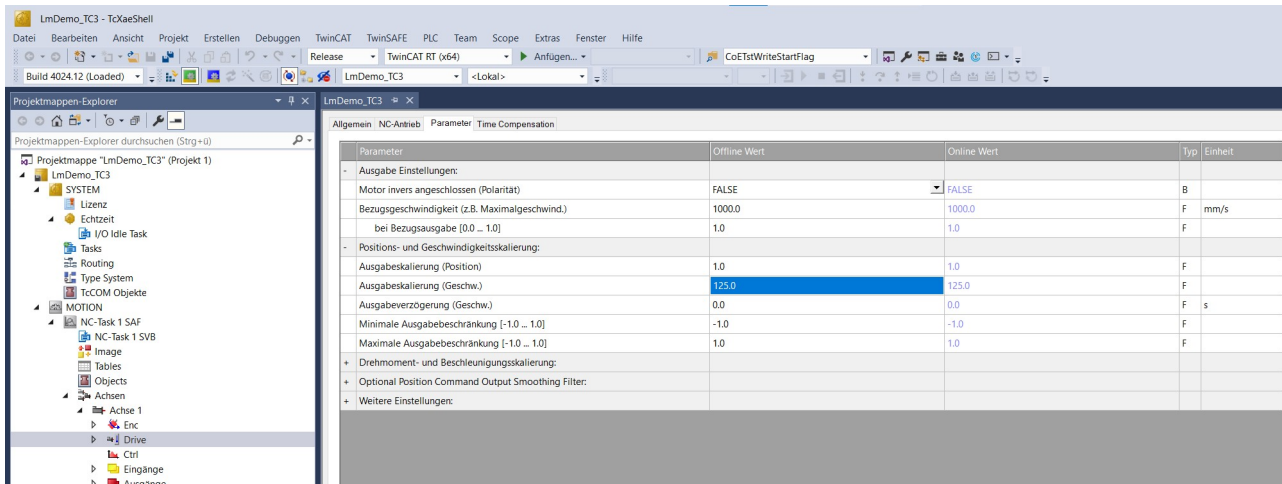


Scan for EtherCAT slave devices

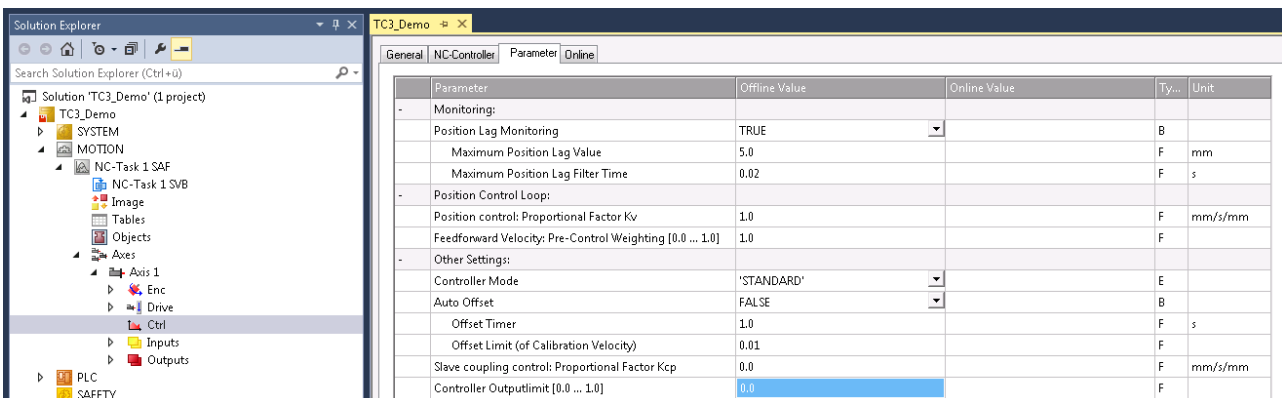


With the question Add drives to NC-configuration select yes.

These steps add the servo drive and its NC-axis to the project.



Then the velocity output scale factor has to be set to 125.0 for correct operation



Though the position controlling is done in the drive the controller output has to be set to 0. If this is forgotten, the behaviour could be noisy. To set these NC parameters they have to be downloaded.

Solution Explorer

Search Solution Explorer (Ctrl+Q)

Solution 'F1150_DS_UC_3S' (1 project)

- F1150_DS_UC_3S
 - SYSTEM
 - MOTION
 - NC-Task 1 SAF
 - NC-Task 1 SVB
 - Image
 - Tables
 - Objects
 - Axes
 - Axis 1
 - Enc
 - Drive
 - Inputs
 - Outputs
 - Ctrl
 - Inputs
 - Outputs
 - PLC
 - SAFETY
 - C++
 - ANALYTICS
 - I/O
 - Devices
 - Device 3 (EtherCAT)
 - Image
 - Image-Info
 - SyncUnits
 - Inputs
 - Outputs
 - InfoData
 - Box 1 (F1150-DS-UC-3S V1.0)
 - Mappings
 - NC-Task 1 SAF - Device 3 (EtherCAT) 1
 - NC-Task 1 SAF - Device 3 (EtherCAT) Info

F1150_DS_UC_3S

General EtherCAT DC Process Data Plc Startup CoE - Online Online NC: Online NC: Functions

8.5461

Setpoint Position: [mm] 8.5768

Lag Distance (min/max): [mm] 0.0307 (-0.005, 0.523)

Actual Velocity: [mm/s] 0.0087

Setpoint Velocity: [mm/s] 0.0000

Override: [%] 100.0000 %

Total / Control Output: [%] 0.00 / 0.00 %

Error: 0 (0x0)

Status (log.)

- ☒ Ready
- ☒ NOT Moving
- ☐ Calibrated
- ☐ Moving Fw
- ☐ Has Job
- ☐ Moving Bw

Status (phys.)

- ☐ Coupled Mode
- ☒ In Target Pos.
- ☒ In Pos. Range

Enabling

- ☒ Controller
- ☒ Feed Fw
- ☒ Feed Bw

Set

Controller Kv-Factor: [mm/s/mm] 1

Reference Velocity: [mm/s] 2200

Target Position: [mm] 0

Target Velocity: [mm/s] 0

F1 F2 F3 F4 F5 F6 F8 F9

| Name | Online | Type | Size | >Addr... | In/Out | User ID | Linked to |
|----------------------|--------|-------|------|----------|--------|---------|---------------------------------|
| Statusword | X | UINT | 2.0 | 71.0 | Input | 0 | nState1, nState2 |
| Position actual v... | X | DINT | 4.0 | 73.0 | Input | 0 | nDataIn1 . In . Inputs . En... |
| Position demand... | X | DINT | 4.0 | 77.0 | Input | 0 | |
| Torque actual val... | X | INT | 2.0 | 81.0 | Input | 0 | nDataIn3[0] . nDataIn3 . I... |
| Modes of operat... | X | SINT | 1.0 | 83.0 | Input | 0 | nState5 . In . Inputs . Driv... |
| Padding Byte | 0 | USINT | 1.0 | 84.0 | Input | 0 | |
| WcState | X | BIT | 0.1 | 1522.3 | Input | 0 | nState4, nState4 |
| InputToggle | X | BIT | 0.1 | 1524.3 | Input | 0 | nState4, nState4 |
| State | 8 | UINT | 2.0 | 1548.0 | Input | 0 | |

Now the servo drive can be used with system manager NC functionality when started.

3 Operation Modes

The device profile defines several modes of operation. The user will be able to activate the required function by selecting the mode of operation. They include profile position mode, homing mode, interpolated position mode, profile velocity mode, profile torque mode, velocity mode, cyclic synchronous position mode, cyclic synchronous velocity mode, and cyclic synchronous torque mode. The control word, status word and the setpoints are used mode-specific.

Object 6040h : Control Word

| | | | | | | | | | | | |
|-----------|----------|------------|----------|-----------|------------|-----------|-----------|-----------|-----------|---|-----|
| 15 | 11 | 10 | 9 | 8 | 7 | 6 | 4 | 3 | 2 | 1 | 0 |
| <i>ms</i> | <i>r</i> | <i>oms</i> | <i>h</i> | <i>fr</i> | <i>oms</i> | <i>eo</i> | <i>qs</i> | <i>ev</i> | <i>so</i> | | |
| MSB | | | | | | | | | | | LSB |

LEGEND: ms = manufacturer-specific; r = reserved; oms = operation mode specific; h = halt; fr = fault reset; eo = enable operation; qs = quick stop; ev = enable voltage; so = switch on

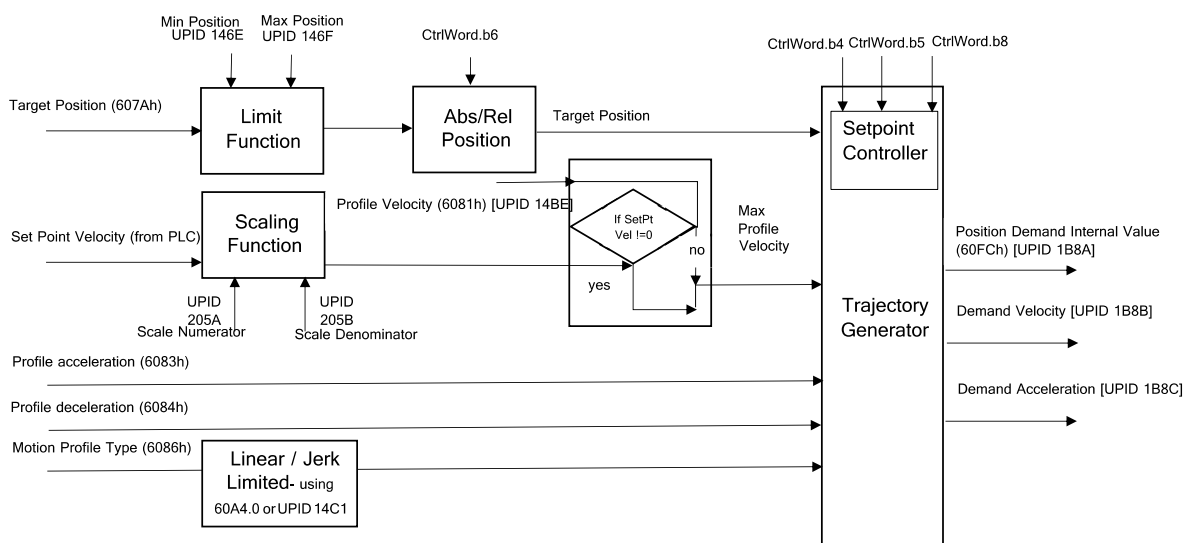
Object 6041h: Status Word

| | | | | | | | | | | | | | | | |
|-----------|------------|------------|-----------|-----------|-----------|----------|------------|-----------|-----------|----------|-----------|-----------|-------------|---|-----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| <i>ms</i> | <i>oms</i> | <i>ila</i> | <i>tr</i> | <i>rm</i> | <i>ms</i> | <i>w</i> | <i>sod</i> | <i>qs</i> | <i>ve</i> | <i>f</i> | <i>oe</i> | <i>so</i> | <i>rtso</i> | | |
| MSB | | | | | | | | | | | | | | | LSB |

LEGEND: ms = manufacturer-specific; oms = operation mode specific; ila = internal limit active; tr = target reached; rm = remote; w = warning; sod = switch on disabled; qs = quick stop; ve = voltage enabled; f = fault; oe = operation enabled; so = switched on; rtso = ready to switch on

3.1 Profile Position Mode (OpMode 1)

A target position is applied to the trajectory generator. It is generating a position demand value for the position control loop. Please check the below figure for the details of the scales/ limits applied for position, velocity and the other inputs like acceleration, deceleration and the selection of motion profile type.



Use of Control Word

| | | | | | | | | | |
|-----------------------------|---------------------|------|-----------------------------|---------|------------------------|--------------|-----------------------------|---|-----|
| 15 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 0 |
| See operation modes chapter | Change on set point | Halt | See operation modes chapter | Abs/rel | Change set immediately | New setpoint | See operation modes chapter | | |
| MSB | | | | | | | | | LSB |

The setting of the setpoints is controlled by the control word bit 4 - *new setpoint* and control word bit 5 - *change set immediately*. When the bit 4 is 1, the new setpoint is buffered in the set point list as long as the free set-points are available in the drive device. If there is no setpoint in progress, then the new setpoint shall become active immediately. If a setpoint is in progress the new setpoint will be stored in the buffer that is free. When the *change set immediately* bit of the controlword is set to 1, a single set-point is expected. All previously loaded set-points shall be discarded.

When the control word bit 6 is 0, the absolute value is taken for target position calculation. If the control word bit 6 is 1, the relative position is taken.

When the control word bit 8 - *halt* is 1 the axis will freeze . The *not freeze* bit of the control word (UPID 1D5B) will be thereby 0. When the *halt* bit is 0, the positioning shall be executed or continued and the *not freeze* bit of the control word will be 1.

The control word bit 9 - *change on set point* is fixed to 0. A change to 1 is currently not supported.

Use of Status Word

| | | | | | | | |
|-----------------------------|-----------------|---------------|-----------------------------|----------------|-----------------------------|---|-----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 0 |
| See operation modes chapter | Following error | Set-point ack | See operation modes chapter | Target reached | See operation modes chapter | | |
| MSB | | | | | | | LSB |

Status word bit 10 - *target reached* is implemented as the invert bit of *motion active*- MC SW status word bit 13. This bit can also be watched in UPID 1D77h. The bit 12 *set point ack* is 1 when the new setpoint is in process. *Set point ack* will be 0 when the previous setpoint is already processed.

Status word bit 13 is currently not supported.

3.2 Homing Mode (OpMode 6)

This mode describes the method by which the drive goes to home position. The different modes of homing are listed in UPID 13C4h. The homing method has to be selected using the LinMot Tool. The UPID 13C4h gives different UPID selection.

Control Word

| | | | | | | | | |
|-----------------------------|------|-----------------------------|--------------|------------------------|-----------------------------|---|---|-----|
| 15 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 0 |
| See operation modes chapter | Halt | See operation modes chapter | Reserved (0) | Homing Operation Start | See operation modes chapter | | | |
| MSB | | | | | | | | LSB |

The bit 4 of control word - Homing operation start is linked to the UPID 1D61h. The bit 8 halt is not supported in this version.

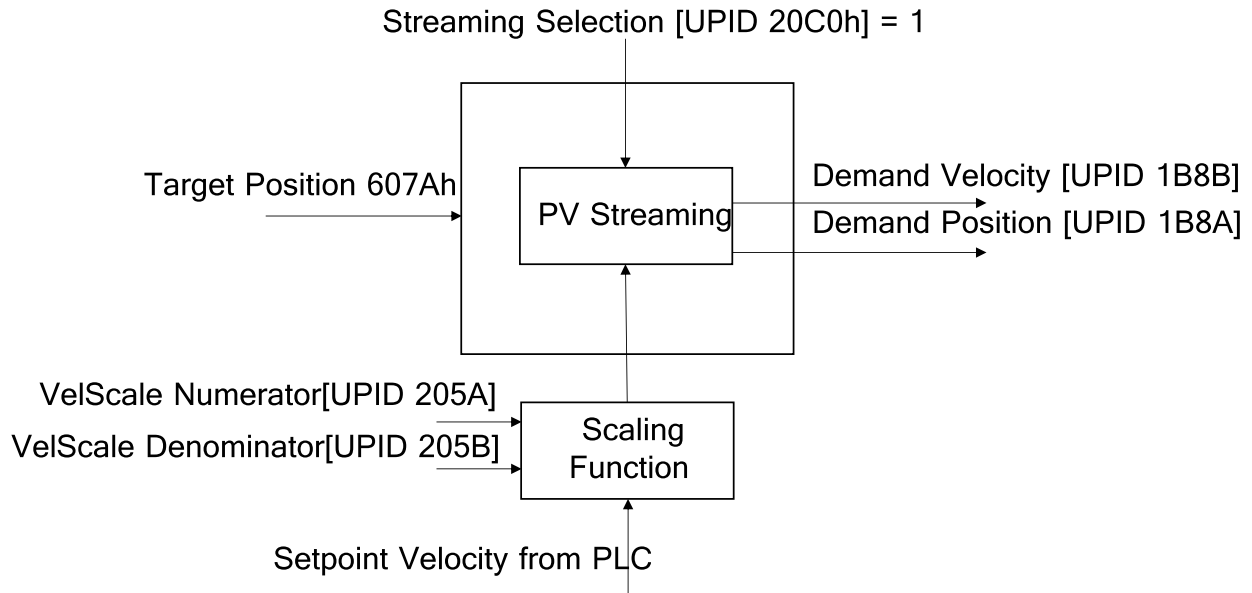
Status Word

| | | | | | | | |
|-----------------------------|--------------|-----------------|-----------------------------|----------------|-----------------------------|---|-----|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 0 |
| See operation modes chapter | Homing error | Homing Attained | See operation modes chapter | Target reached | See operation modes chapter | | |
| MSB | | | | | | | LSB |

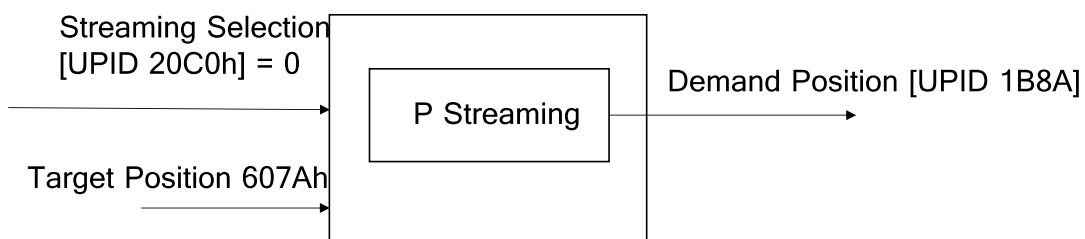
The bit 10 of status word is 1 when the homing is interrupted or not started. When the homing is finished the bit 10 and bit 12 are high.

3.3 Cyclic Sync Position Mode (OpMode 8)

In this operation mode, it provides a target position to the drive device, which performs position control and velocity control depends on the user input to the UPID 20C0h. The behavior of the control function is influenced by the control parameters like the limit functions. The default selection of OpMode 8 in Streaming Selection - UPID 20C0h is 1 which is PV streaming.

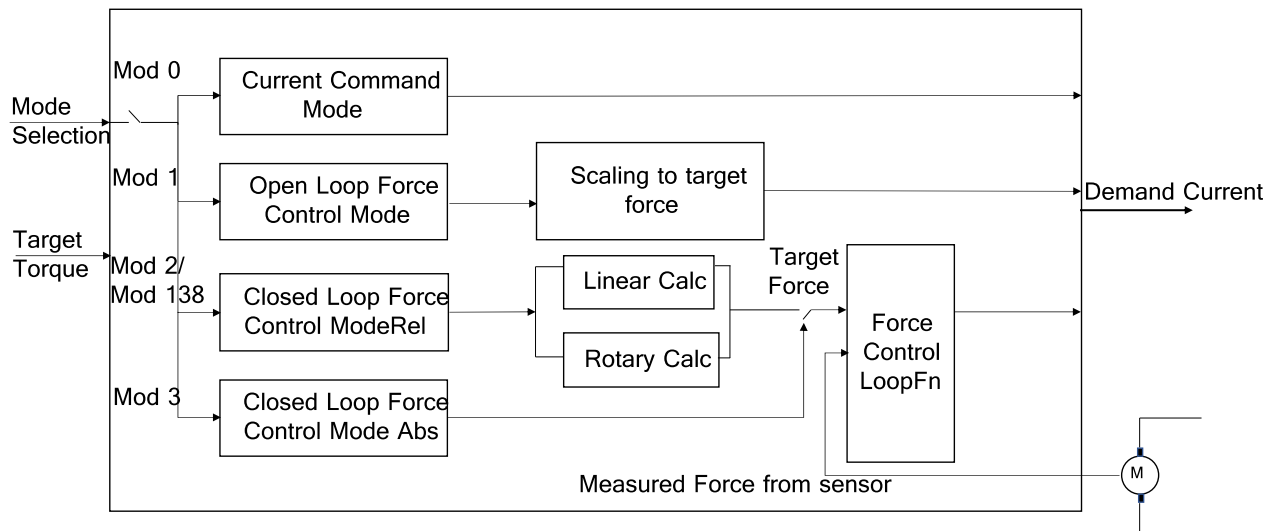


The legacy mode is P streaming which is selected by Streaming Selection - UPID 20C0h as 0. This is also supported.



3.4 Cyclic Sync Torque Mode (OpMode 10)

In this mode, the trajectory generator will provide the target force/torque to the drive. There are 4 modes of selection based on the user input on UPID 2070h. They are current command mode, openloop force/torque control mode, closed loop force/torque control mode relative, closed loop force/torque Ctrl Mode Abs. This mode is used by the PDO 0x1604 and 0x1614.



4 Process Data Object (PDO) Configuration

The cyclic process data is configured in the master and transmitted to the slave during startup. The default mapping is documented in the tables below. The inputs and outputs correspond to the PLC point of view. For a detailed description of the exchanged data and its meaning refer to [1].

For a detailed description of the PDO data refer to [1] or have a look at the TwinCAT demo program, which is included with the LinMot-Talk software.

4.1 Input PDO Modules

General
TwinCAT 3
F1150_DS_UC_3S

Process Data
Plc
Startup
CoE - Online
Online
NC: Online
NC: Functions

Sync Manager:

| SM | Size | Type | Flags |
|----|------|---------|-------|
| 0 | 128 | MbxOut | |
| 1 | 128 | MbxIn | |
| 2 | 14 | Outputs | |
| 3 | 14 | Inputs | |

PDO List:

| Index | Size | Name | Flags | SM | SU |
|--------|------|--------------------------------------|-------|----|----|
| 0x1A02 | 16.0 | Cyclic Mode Inputs | F | | 0 |
| 0x1A03 | 14.0 | Cyclic Mode Inputs 2 | F | 3 | 0 |
| 0x1A12 | 14.0 | Cyclic Inputs | F | | 0 |
| 0x1A20 | 0.0 | User Defined Inputs | | | 0 |
| 0x1A21 | 0.0 | User Defined Inputs_2 | | | 0 |
| 0x1B00 | 18.0 | LinMot Intf In | F | | 0 |
| 0x1B08 | 8.0 | Config Module Input | F | | 0 |
| 0x1B10 | 4.0 | Input DemVel | F | | 0 |
| 0x1B11 | 4.0 | Input ActVel | F | | 0 |
| 0x1B12 | 4.0 | Input ActVelFilt | F | | 0 |
| 0x1B16 | 4.0 | Input DemCurrFilt | F | | 0 |
| 0x1B28 | 4.0 | Mon Channel 1 | F | | 0 |
| 0x1B29 | 4.0 | Mon Channel 2 | F | | 0 |
| 0x1B2A | 4.0 | Mon Channel 3 | F | | 0 |
| 0x1B2B | 4.0 | Mon Channel 4 | F | | 0 |
| 0x1604 | 14.0 | Cyclic Position Velocity Torque Mode | | 2 | 0 |

PDO Assignment (0x1C13):

| | |
|-------------------------------------|--------|
| ☐ | 0x1A02 |
| ☒ | 0x1A03 |
| ☐ | 0x1A12 |
| ☐ | 0x1A20 |
| ☐ | 0x1A21 |
| ☐ | 0x1B00 |
| ☐ | 0x1B08 |
| ☐ | 0x1B10 |
| ☐ | 0x1B11 |
| ☐ | 0x1B12 |
| ☐ | 0x1B16 |
| ☐ | 0x1B28 |
| ☐ | 0x1B29 |
| ☐ | 0x1B2A |
| ☐ | 0x1B2B |

Download

☒ PDO Assignment
☒ PDO Configuration

PDO Content:

| Index | Size | Offs | Name | Type | Default (hex) |
|-------|------|------|------|------|---------------|
|-------|------|------|------|------|---------------|

Predefined PDO Assignment: (none)

Load PDO info from device

Sync Unit Assignment...

Overview of the predefined Input Process data objects

4.1.1 Cyclic Mode Inputs 0x1A02

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|---------------------------|-----------|
| 0x1A02 | 16 | - | Variables | RECORD |
| 0x6041:00 | 2 | 0 | Statusword | Uint16 |
| 0x6064:00 | 4 | 2 | Position actual value | Int32 |
| 0x6062:00 | 4 | 6 | Position demand value | Int32 |
| 0x3B93:00 | 4 | 10 | DemandCurrent | Int32 |
| 0x6061:00 | 1 | 14 | Mode of Operation display | Byte |
| 0x424F:00 | 1 | 15 | Padding Byte | Byte |

This module could be used to map the inputs of an CiA402 NC axis.

4.1.2 Cyclic Mode Inputs 2 0x1A03

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|---------------------------|-----------|
| 0x1A03 | 14 | - | Variables | RECORD |
| 0x6041:00 | 2 | 0 | Statusword | Uint16 |
| 0x6064:00 | 4 | 2 | Position actual value | Int32 |
| 0x6062:00 | 4 | 6 | Position demand value | Int32 |
| 0x6077:00 | 2 | 10 | Torque actual value | Int16 |
| 0x6061:00 | 1 | 12 | Mode of Operation display | Byte |
| 0x424F:00 | 1 | 13 | Padding Byte | Byte |

This module could be used to map the inputs of an CiA402 NC axis.

The "Torque actual value" is calculated out of the "Actual Torque/Force" (UPID: 1BBFh/1BFFh) multiplied with 5000 divided with the "Maximal Torque/Force" (UPID: 1BBEh/1BB0h).

If the Closed Loop Force Control Mode is active the measured torque/force (UPID: 1EA1h) is taken to calculate the " Actual Torque/Force".

4.1.3 Cyclic Inputs 0x1A12

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|-----------------------|-----------|
| 0x1A12 | 14 | - | Variables | RECORD |
| 0x6041:00 | 2 | 0 | Statusword | Uint16 |
| 0x6064:00 | 4 | 2 | Position actual value | Int32 |
| 0x6062:00 | 4 | 6 | DemandPosition | Int32 |
| 0x3B93:00 | 4 | 10 | DemandCurrent | Int32 |

This module could be used to map the inputs of an CiA402 NC axis.

4.1.4 User Defined Inputs 0x1A20

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|--------|-------------|-------------|---|-----------|
| 0x1A20 | 2..32 | - | Variables | RECORD |
| 1..8 | | | User defined Parameter/Variables accessed by UPID | |

The PDO 0x1A20 could be used, to read Variables/Parameters for which no predefined PDO exists. It is possible to map 1 to 8 entries defined by its UPID in this PDO. The defined Size of the data has to match with the size, defined by the UPID.

The user can choose from the following list of CiA402 object dictionaries.

Edit Pdo Entry
✕

Name:

OK

Index (h/d):

Cancel

Sub Index (h/d):

Data Type:

Bit Length:

From Dictionary:

0x10F8 - Timestamp Object
0x3B62 - StateVar
0x3B98 - DemandCurrentFilt
0x3BAF - ActualVelocityFilt
0x3D51 - StatusWord
0x3D8E - WarnWord
0x40A8 - Mon Channel 1
0x40A9 - Mon Channel 2
0x40AA - Mon Channel 3
0x40AB - Mon Channel 4
0x41E8 - Config Status Word
0x41E9 - Config Index In
0x41EA - Config Value In
0x603E - Error code

Please note that the minimum size of PDO is 2 byte. Therefore for eg 0x6061 where the data size is 1 byte by default needs to be reassigned to 2 byte to avoid error.

4.1.5 User Defined Inputs_2 0x1A21

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|--------|-------------|-------------|---|-----------|
| 0x1A21 | 2..64 | - | Variables | RECORD |
| 1..16 | | | User defined Parameter/Variables accessed by UPID | |

The PDO 0x1A21 could be used, to read Variables/Parameters for which no predefined PDO exists. It is possible to map 1 to 8 entries defined by its UPID in this PDO. The defined Size of the data has to match with the size, defined by the UPID.

The user can choose from the following list of CiA402 object dictionaries.

Edit Pdo Entry
✕

Name:

Index (h/d):

Sub Index (h/d):

Data Type: USINT ▼

Bit Length: ▲▼

OK

Cancel

From Dictionary:

0x10F8 - Timestamp Object

0x3B62 - StateVar

0x3B98 - DemandCurrentFilt

0x3BAF - ActualVelocityFilt

0x3D51 - StatusWord

0x3D8E - WarnWord

0x40A8 - Mon Channel 1

0x40A9 - Mon Channel 2

0x40AA - Mon Channel 3

0x40AB - Mon Channel 4

0x41E8 - Config Status Word

0x41E9 - Config Index In

0x41EA - Config Value In

0x603E - Error code

Please note that the minimum size of PDO is 2 byte. Therefore for eg 0x6061 where the data size is 1 byte by default needs to be reassigned to 2 byte to avoid error.

4.1.6 LinMot Intf In 0x1B00

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|---------------|-------------|-------------|------------------|---------------|
| 0x1B00 | 18 | - | Variables | RECORD |
| 0x3B62:00 | 2 | 0 | StateVar | Uint16 |
| 0x3D51:00 | 2 | 2 | StatusWord | Uint16 |
| 0x3D8E:00 | 2 | 4 | WarnWord | Uint16 |
| 0x6062:00 | 4 | 6 | DemandPosition | Int32 |
| 0x6064:00 | 4 | 10 | ActualPosition | Int32 |
| 0x3B93:00 | 4 | 14 | DemandCurrent | Int32 |

The Default input PDO mapping of 18 Bytes the index is the UPID value of the variable.

4.1.7 Config Module 0x1B08

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|--------------------|-----------|
| 0x1B08 | 8 | - | Variables | RECORD |
| 0x41E8:00 | 2 | 0 | Config Status Word | Uint16 |
| 0x41E9:00 | 2 | 2 | Config Index/.. | Uint16 |
| 0x41EA:00 | 4 | 4 | Config Value | Word32 |

This module is the feedback data module of the module 1708 "Configuration Module Output".

4.1.8 Input Demvel 0x1B10

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|-----------------------|-----------|
| 0x1B10 | 4 | - | Variables | |
| 0x606B:00 | 4 | 0 | velocity demand value | Int32 |

The Demand Velocity is backscaled with the parameters "Velocity Scale Denominator" and "Velocity Scale Numerator".

4.1.9 Input DemCurrFilt 0x1B16

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|-------------------------|-----------|
| 0x1B16 | 4 | - | Variables | |
| 0x3B98:00 | 4 | 0 | Demand Current Filtered | Int32 |

The Demand Current filtered (UPID 1B98).

4.1.10 Input ActVelFilt 0x1B11

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|-----------------------|-----------|
| 0x1B11 | 4 | - | Variables | |
| 0x606C:00 | 4 | 0 | Velocity actual value | Int32 |

The "ActualVelocity" is backscaled with the parameters "Velocity Scale Denominator" and "Velocity Scale Numerator".

4.1.11 Input ActVelFilt 0x1B12

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|--------------------|-----------|
| 0x1B12 | 4 | - | Variables | |
| 0x3BAF:00 | 4 | 0 | ActualVelocityFilt | Int32 |

The "ActualVelocityFilt" is backscaled with the parameters "Velocity Scale Denominator" and "Velocity Scale Numerator".

4.1.12 Mon Channel 1 0x1B28

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|---------------|-----------|
| 0x1B28 | 4 | - | Variables | |
| 0x40A8:00 | 4 | 0 | Mon Channel 1 | Int32 |

The data of the variable which is defined by the parameter Channel 1 UPID.

4.1.13 Mon Channel 2 0x1B29

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|---------------|-----------|
| 0x1B29 | 4 | - | Variables | |
| 0x40A9:00 | 4 | 0 | Mon Channel 2 | Int32 |

The data of the variable which is defined by the parameter Channel 2 UPID.

4.1.14 Mon Channel 3 0x1B2A

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|---------------|-----------|
| 0x1B2A | 4 | - | Variables | |
| 0x40AA:00 | 4 | 0 | Mon Channel 3 | Int32 |

The data of the variable which is defined by the parameter Channel 3 UPID.

4.1.15 Mon Channel 4 0x1B2B

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|---------------|-----------|
| 0x1B2B | 4 | - | Variables | |
| 0x40AB:00 | 4 | 0 | Mon Channel 4 | Int32 |

The data of the variable which is defined by the parameter Channel 4 UPID.

4.2 Output PDO Modules

General
EtherCAT
DC
Process Data
Plc
Startup
CoE - Online
Online
NC: Online
NC: Functions

Sync Manager:

| SM | Size | Type | Flags |
|----|------|---------|-------|
| 0 | 128 | MbxOut | |
| 1 | 128 | MbxIn | |
| 2 | 14 | Outputs | |
| 3 | 14 | Inputs | |

PDO List:

| Index | Size | Name | Flags | SM | SU |
|--------|------|-----------------------|-------|----|----|
| 0x1A02 | 16.0 | Cyclic Mode Inputs | F | | 0 |
| 0x1A03 | 14.0 | Cyclic Mode Inputs 2 | F | 3 | 0 |
| 0x1A12 | 14.0 | Cyclic Inputs | F | | 0 |
| 0x1A20 | 0.0 | User Defined Inputs | | | 0 |
| 0x1A21 | 0.0 | User Defined Inputs_2 | | | 0 |
| 0x1B00 | 18.0 | LinMot Intf In | F | | 0 |
| 0x1B08 | 8.0 | Config Module Input | F | | 0 |
| 0x1B10 | 4.0 | Input DemVel | F | | 0 |
| 0x1B11 | 4.0 | Input ActVel | F | | 0 |
| 0x1B12 | 4.0 | Input ActVelFilt | F | | 0 |
| 0x1B16 | 4.0 | Input DemCurrFilt | F | | 0 |
| 0x1B28 | 4.0 | Mon Channel 1 | F | | 0 |

PDO Assignment (0x1C12):

- ☒ 0x1604
- ☐ 0x1620
- ☐ 0x1700 (excluded by 0x1604)
- ☐ 0x1708
- ☐ 0x1710
- ☐ 0x1711
- ☐ 0x1728
- ☐ 0x1729
- ☐ 0x172A
- ☐ 0x172B

PDO Content (0x1A03):

| Index | Size | Offs | Name | Type | Default (hex) |
|-----------|------|------|----------------------------|-------|---------------|
| 0x6041:00 | 2.0 | 0.0 | Statusword | UINT | |
| 0x6064:00 | 4.0 | 2.0 | Position actual value | DINT | |
| 0x6062:00 | 4.0 | 6.0 | Position demand value | DINT | |
| 0x6077:00 | 2.0 | 10.0 | Torque actual value | INT | |
| 0x6061:00 | 1.0 | 12.0 | Modes of operation display | SINT | |
| 0x424F:00 | 1.0 | 13.0 | Padding Byte | USINT | |
| | | 14.0 | | | |

Overview of the predefined Output Process data objects

4.2.1 Cyclic Position Velocity Torque Mode 0x1604

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|-------------------|-----------|
| 0x1604 | 14 | - | Variables | RECORD |
| 0x6040:00 | 2 | 0 | Controlword | Word16 |
| 0x607A:00 | 4 | 2 | Target position | Int32 |
| 0x60FF:00 | 4 | 6 | Target velocity | Int32 |
| 0x6071:00 | 2 | 10 | Target torque | Int16 |
| 0x6060:00 | 1 | 12 | Mode of Operation | Byte |
| 0x424E:00 | 1 | 13 | Byte Padding | Byte |

This module can be used, if the operation mode has to be changed during run time. At the moment the cyclic position mode (0x08), the cyclic torque mode (0xA) and the cyclic closed loop torque mode (0x8A) are supported. To change the operation mode simply change the value of "Mode of Operation" variable.

Object 0x1604 defines the transmit PDO mapping for cyclic synchronous operation.

In addition to the default configuration, the firmware supports several predefined alternative mappings that differ in size and included control variables. These variants are selected implicitly based on the number of mapped entries (SubIndex 0) of object 0x1604 and the corresponding consecutive subindex values that define the PDO mapping entries.

Supported alternate PDO Configurations

- Former Object 0x1603 – **Cyclic Position Velocity Mode** (12 bytes)
Similar to 0x1604 but with reduced content (no target torque) - S11 = 0x6040 Controlword, S12 = 0x607A Target Position, S13 = 0x60FF Target Velocity, S14 = 0x6060 Mode of Operation, S15 = 0x424E, Byte Padding.
→ Used when most control functionality is needed with slightly reduced PDO size.
- Former Object 0x1602 – **Cyclic Position Mode** (8 bytes)
Contains Controlword and Target Position only - S11 = 0x6040 Controlword, S12 = 0x607A Target Position, S13 = 0x6060 Mode of Operation, S14 = 0x424E, Byte Padding.
→ Used for pure cyclic position control without velocity or torque commands.
- Former Object 0x1606 – **Cyclic Torque Mode** (8 bytes)
Compact mapping variant with limited entries - S11 = 0x6040 Controlword, S12 = 0x6071 Target Torque, S13 = 0x6060 Mode of Operation, S14 = 0x424E, Byte Padding.
→ Used for torque mode without position and velocity.
- Former Object 0x1613 – **Cyclic Position Velocity** (10 bytes)
Includes Controlword, Target Position, and target velocity - S11 = 0x6040 Controlword, S12 = 0x607A Target Position, S13 = 0x60FF Target Velocity.
→ There is no Mode of Operation.
- Former Object 0x1614 – **Cyclic Position Velocity Torque** (12 bytes)
Includes position velocity and torque. 0x6040 Controlword, 0x607A Target Position, 0x60FF Target Velocity, 0x6071 Target Torque.
→ Used when extended control is required but full mapping (1604) is not necessary.

4.2.2 User Defined Outputs 0x1620

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|--------|-------------|-------------|---|-----------|
| 0x1620 | 2..32 | - | Variables | RECORD |
| 1..8 | | | User defined Parameter/Variables accessed by UPID | |

The PDO 0x1620 could be used to set Variables/Parameters for which no predefined PDO exists. It is possible to map 1 to 8 entries defined by its UPID in this PDO. Allowed are only 16 or 32 bit entries. The defined Size of the data has to match with the size defined with the UPID.

The user can choose from the following list of CiA 402 object dictionaries.

×

Edit Pdo Entry

Name:

Index (h/d):

0x0

0

Sub Index (h/d):

0x0

0

Data Type:

USINT

Bit Length:

8

OK

Cancel

From Dictionary:

0x33A6 - Max Current Set A

0x3B93 - DemandCurrent

0x3D52 - ControlWord

0x3DB0 - MotionCommandHeader

0x3E40 - Motion Command Par 1

0x3E41 - Motion Command Par 2

0x3E42 - Motion Command Par 3

0x3E43 - Motion Command Par 4

0x3E44 - Motion Command Par 5

0x40B0 - Par Channel 1

0x40B1 - Par Channel 2

0x40B2 - Par Channel 3

0x40B3 - Par Channel 4

0x41E0 - Config Control Word

4.2.3 LinMot Intf Out 0x1700

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|---------------|-------------|-------------|---------------------|---------------|
| 0x1700 | 24 | - | Variables | RECORD |
| 0x3D52:00 | 2 | 0 | ControlWord | Uint16 |
| 0x3DB0:00 | 2 | 2 | MotionCommandHeader | Uint16 |
| 0x3E40:00 | 4 | 4 | MotionCommand Par 1 | Word32 |
| 0x3E41:00 | 4 | 8 | MotionCommand Par 2 | Word32 |
| 0x3E42:00 | 4 | 12 | MotionCommand Par 3 | Word32 |
| 0x3E43:00 | 4 | 16 | MotionCommand Par 4 | Word32 |
| 0x3E44:00 | 4 | 20 | MotionCommand Par 5 | Word32 |

Default output PDO mapping of 24 Bytes the index is the UPID value of the variable

The default PDO output data contains the control word and the generic motion command interface over which all types of motion commands can be accessed.

4.2.4 Config Module 0x1708

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|---------------|-------------|-------------|---------------------|---------------|
| 0x1708 | 8 | - | Variables | RECORD |
| 0x41E0:00 | 2 | 0 | Config Control Word | Uint16 |
| 0x41E1:00 | 2 | 2 | Config Index/.. | Uint16 |
| 0x41E2:00 | 4 | 4 | Config Value | Word32 |

With this module the LinMot drive can be completely configured. So it gives access over parameters curves command table entries and the error log. The detail functionality is described in the document [2] "Configuration over fieldbus SG5". As response module "Configuration Module Input" (0x1B08) has to be configured.

4.2.5 Max Current Set A 0x1710

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|---------------|-------------|-------------|-------------------|-----------|
| 0x1710 | 4 | - | Variables | |
| 0x33A6:00 | 4 | 0 | Max Current Set A | Uint32 |

Could be used to change the maximal current of the position controller set A, during runtime.

4.2.6 Torque/force limits 0x1711

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|--|-----------|
| 0x1711 | 4 | - | Variables | RECORD |
| 0x60E0:00 | 2 | 0 | Positive torque/force limit 5000 = maximal torque value positive | Uint16 |
| 0x60E1:00 | 2 | 2 | Negative torque/force limit 5000 = maximal torque value negative | Uint16 |

With this module the positive and negative torque/force value could be individually set cyclic.

4.2.7 Par Channel 1 0x1728

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|--------------------------------------|-----------|
| 0x1728 | 4 | - | Variables | RECORD |
| 0x40B0:00 | 4 | 0 | Value written to parameter/variable. | Int32 |

With this module a parameter/variable could be directly written from the PLC the parameter/variable is defined by the parameter "Channel 1 UPID".

4.2.8 Par Channel 2 0x1729

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|--------------------------------------|-----------|
| 0x1729 | 4 | - | Variables | RECORD |
| 0x40B1:00 | 4 | 0 | Value written to parameter/variable. | Int32 |

With this module a parameter/variable could be directly written from the PLC the parameter/variable is defined by the parameter "Channel 2 UPID".

4.2.9 Par Channel 3 0x172A

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|--------------------------------------|-----------|
| 0x1728 | 4 | - | Variables | RECORD |
| 0x40B2:00 | 4 | 0 | Value written to parameter/variable. | Int32 |

With this module a parameter/variable could be directly written from the PLC the parameter/variable is defined by the parameter "Channel 3 UPID".

4.2.10 Par Channel 4 0x172B

| Index | Size [Byte] | Byte Offset | Name | Data Type |
|-----------|-------------|-------------|--------------------------------------|-----------|
| 0x1728 | 4 | - | Variables | RECORD |
| 0x40B3:00 | 4 | 0 | Value written to parameter/variable. | Int32 |

With this module a parameter/variable could be directly written from the PLC the parameter/variable is defined by the parameter "Channel 4 UPID".

4.3 Typical Startup Telegrams

| f1150 | | | | |
|--|----------|-----------|-------------------------------|-------------------------------|
| General EtherCAT DC Process Data Plc Startup CoE - Online Online | | | | |
| Transition | Protocol | Index | Data | Comment |
| C <PS> | CoE | 0x1C12:00 | 0x00 (0) | clear sm pdos (0x1C12) |
| C <PS> | CoE | 0x1C13:00 | 0x00 (0) | clear sm pdos (0x1C13) |
| C <PS> | CoE | 0x1A20:00 | 0x00 (0) | clear pdo 0x1A20 entries |
| C <PS> | CoE | 0x1A21:00 | 0x00 (0) | clear pdo 0x1A21 entries |
| C <PS> | CoE | 0x1604:00 | 0x00 (0) | clear pdo 0x1604 entries |
| C <PS> | CoE | 0x1604:01 | 0x6040:00, 16 | download pdo 0x1604 entry |
| C <PS> | CoE | 0x1604:02 | 0x607A:00, 32 | download pdo 0x1604 entry |
| C <PS> | CoE | 0x1604:03 | 0x6060:00, 8 | download pdo 0x1604 entry |
| C <PS> | CoE | 0x1604:04 | 0x424E:00, 8 | download pdo 0x1604 entry |
| C <PS> | CoE | 0x1604:00 | 0x04 (4) | download pdo 0x1604 entry ... |
| C <PS> | CoE | 0x1620:00 | 0x00 (0) | clear pdo 0x1620 entries |
| C <PS> | CoE | 0x1C13:01 | 0x1A03 (6659) | download pdo 0x1C13:01 in... |
| C <PS> | CoE | 0x1C13:00 | 0x01 (1) | download pdo 0x1C13 count |
| E <IP, PS> | EoE | | 3F 00 00 00 02 01 05 20 03... | ee init |

This figure shows the startup telegram list of LinMot CiA402 servo drive from TwinCat Beckhoff

The image shown above represents a typical startup telegrams as generated by Beckhoff tools. In a minimal configuration, Only 0x1C12 and 0x1C13 are strictly required. PDO mapping objects (0x1604, 0x1620, 0x1A20, 0x1A21) are configured only if the corresponding process data is needed. For details of optional configuration please refer to the corresponding PDO Configuration section.

5 Asynchronous Configuration Protocol CoE

For configuration purpose (Parameter Handling) the standard Sercos over EtherCAT CoE-Protocol is used.

5.1 Communication CiA402 Profile Area(1000h-1FFFh)

General
EtherCAT
DC
Process Data
Plc
Startup
CoE - Online
Online
NC: Online
NC: Functions

Update List
☐ Auto Update
☒ Single Update
☐ Show Offline Data

Advanced...

Add to Startup...
Online Data
Module OD (AoE Port): 0

| Index | Name | Flags | Value |
|----------|--------------------------------------|-------|--|
| 1000 | Device type | RO | 0x00020402 (132098) |
| 1001 | Error register | RO | 0x00 (0) |
| 1008 | Device name | RO | F1150-DS-UC-3S V1.0 |
| 1009 | Manufacturer Hardware version | RO | 1.0 |
| 100A | Manufacturer Software version | RO | 5.13 |
| + 1018:0 | Identity Object | | > 4 < |
| + 10F1:0 | Error Settings | | > 2 < |
| 10F8 | Timestamp Object | RW P | 0xb0a8c1efc2d4e54 (795602348892048980) |
| + 1604:0 | Cyclic Position Velocity Torque Mode | | > 6 < |
| + 1620:0 | User Defined Outputs | | > 0 < |
| + 1700:0 | LinMot Intf Out | | > 7 < |
| + 1708:0 | Config Module Output | | > 3 < |
| + 1710:0 | Max Current Set A | | > 1 < |
| + 1711:0 | Torque/force limits | | > 2 < |
| + 1728:0 | Par Channel 1 | | > 1 < |
| + 1729:0 | Par Channel 2 | | > 1 < |
| + 172A:0 | Par Channel 3 | | > 1 < |
| + 172B:0 | Par Channel 4 | | > 1 < |
| + 1A02:0 | Cyclic Mode Inputs | | > 6 < |
| + 1A03:0 | Cyclic Mode Inputs 2 | | > 6 < |
| + 1A12:0 | Cyclic Inputs | | > 4 < |
| + 1A20:0 | User Defined Inputs | | > 0 < |
| + 1A21:0 | User Defined Inputs_2 | | > 0 < |
| + 1B00:0 | LinMot Intf In | | > 6 < |
| + 1B08:0 | Config Module Input | | > 3 < |
| + 1B10:0 | Input DemVel | | > 1 < |
| + 1B11:0 | Input ActVel | | > 1 < |
| + 1B12:0 | Input ActVelFilt | | > 1 < |
| + 1B16:0 | Input DemCurrFilt | | > 1 < |
| + 1B28:0 | Mon Channel 1 | | > 1 < |
| + 1B29:0 | Mon Channel 2 | | > 1 < |

LinMot CiA402 Object Dictionary

5.1.1 Homing method Object 6098

As homing method only the Device specific values -128..-111 are supported, the object 6098 value is calculated out of the UPID 13C4 (Homing mode) value added with -128.

| UPID 0x13C4 value | Object 0x6098 value | Description |
|-------------------|---------------------|---------------------------------|
| 0 | -128 | Actual Position |
| 1 | -127 | Mechanical Stop Negative Search |
| . | . | . |
| 17 | -111 | No drive Homing |

5.1.2 Homing speeds Object 6099

In the Linmot-drive only one homing speeds exist, therefore writing to subindex 1 or 2 of the object 6099 both changes the value of the UPID 13C8 (Homing Max Speed).

5.2 Manufacturer specific Profile Area(2000h-5FFFh)

Parameters can be modified via their UPIDs (Unique Parameter ID) via CoE. To use a UPID command, an SDO read (FB_EcCoeSdoReadEx) or write (FB_EcCoeSdoWriteEx) has to be performed on the index "2000h + UPID". The sub-index specifies the command which is performed

| Sdo Service | Index | Sub-Index | Description |
|-------------|------------|-----------|--|
| Read | 2000h+UPID | 01h | Parameter UPID read RAM value |
| Write | 2000h+UPID | 01h | Parameter UPID write RAM value |
| Read | 2000h+UPID | 02h | Parameter UPID read ROM value |
| Write | 2000h+UPID | 02h | Parameter UPID write ROM value |
| Read | 2000h+UPID | 03h | Parameter UPID read minimal value |
| Read | 2000h+UPID | 04h | Parameter UPID read maximal value |
| Read | 2000h+UPID | 05h | Parameter UPID read default value |
| Write | 2000h+UPID | 06h | Parameter UPID write RAM and ROM value |
| Write | 2000h | 07h | Parameter Default OS SW instance |
| Write | 2000h | 08h | Parameter Default MC SW instance |
| Write | 2000h | 09h | Parameter Default Intf SW instance |
| Write | 2000h | 0Ah | Parameter Default Appl SW instance |
| Write | 2000h | 0Bh | Reset device |
| Write | 2000h | 18h | Parameter Default MC SW instance with immediate response |
| Write | 2000h | 24h | Parameter Start Read UPID List |
| Read | 2000h | 25h | Parameter Read next UPID List entry |
| Write | 2000h | 26h | Parameter Start Read modified UPID List |
| Read | 2000h | 27h | Parameter Read next modified UPID List entry |
| | | | |
| Write | 2000h | 35h | Stop MC and Appl SW instances |
| Write | 2000h | 36h | Start MC and Appl SW instances |

| Sdo Service | Index | Sub-Index | Description |
|-------------|----------|-----------|---|
| Write | 2000h | 40h | Curves copy curves from RAM to FLASH |
| Write | 2000h | 41h | Curves delete all in RAM |
| Write | 2000h+ID | 50h | Curves start write curve in RAM |
| Write | 2000h+ID | 54h | Curves write curve info block data in RAM |
| Write | 2000h+ID | 53h | Curves write curve set point data in RAM |
| Read | 2000h+ID | 60h | Curves read info and data size |
| Read | 2000h+ID | 61h | Curves read info block data |
| Read | 2000h+ID | 62h | Curves read setpoint data |
| Read | 2000h | 70h | Read error counters |
| Read | 2000h+ID | 71h | Read error code of logged entry |
| Read | 2000h+ID | 72h | Read error time low of logged entry |
| Read | 2000h+ID | 73h | Read error time high of logged entry |
| Read | 2000h+ID | 74h | Read error text stringlet 0 of error code |
| Read | 2000h+ID | 75h | Read error text stringlet 1 of error code |
| Read | 2000h+ID | 76h | Read error text stringlet 2 of error code |
| Read | 2000h+ID | 77h | Read error text stringlet 3 of error code |
| Read | 2000h+ID | 78h | Read error text stringlet 4 of error code |
| Read | 2000h+ID | 79h | Read error text stringlet 5 of error code |
| Read | 2000h+ID | 7Ah | Read error text stringlet 6 of error code |
| Read | 2000h+ID | 7Bh | Read error text stringlet 7 of error code |
| | | | |
| Write | 2000h | 80h | Command Table copy entries from RAM to FLASH |
| Write | 2000h | 81h | Command Table delete all entries in RAM |
| Write | 2000h+ID | 82h | Command Table delete single entry in RAM |
| Write | 2000h+ID | 83h | Command Table start write entry in RAM |
| Write | 2000h+ID | 84h | Command Table write entry data in RAM |
| Read | 2000h+ID | 85h | Command Table read entry data size |
| Read | 2000h+ID | 86h | Command Table read entry data |
| Read | 2000h | 87h | Command Table read presence list entries 0..31 |
| Read | 2000h | 88h | Command Table read presence list entries 32..63 |
| Read | 2000h | 89h | Command Table read presence list entries 64..95 |
| Read | 2000h | 8Ah | Command Table read presence list entries 96..127 |
| Read | 2000h | 8Bh | Command Table read presence list entries 128..159 |
| Read | 2000h | 8Ch | Command Table read presence list entries 160..191 |
| Read | 2000h | 8Dh | Command Table read presence list entries 192..223 |
| Read | 2000h | 8Eh | Command Table read presence list entries 224..255 |

5.2.1 Parameter UPID read RAM value

Read the RAM value of the parameter specified by its UPID, and stores the result in the 4 bytes of the read_buffer.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 01h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + UPID |
| Input | pDstBuf | DWORD | ADR(read_buffer (4bytes)) |
| Input | cbBufLen | UDINT | Always 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.2 Parameter UPID write RAM value

Write the content of the write_buffer to the RAM value of the parameter specified by its UPID. The write_buffer can have an unique size of 4 bytes.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 01h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + UPID |
| Input | pSrcBuf | DWORD | ADR(write_buffer (4bytes)) |
| Input | cbBufLen | UDINT | Always 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.3 Parameter UPID read ROM value

Read the ROM value of the parameter specified by its UPID, and stores the result in the 4 bytes of the read_buffer.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 02h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + UPID |
| Input | pDstBuf | DWORD | ADR(read_buffer (4bytes)) |
| Input | cbBufLen | UDINT | Always 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.4 Parameter UPID write ROM value

Write the content of the write_buffer to the ROM value of the parameter specified by its UPID. The write_buffer can have an unique size of 4 bytes.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 02h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + UPID |
| Input | pSrcBuf | DWORD | ADR(write_buffer (4bytes)) |
| Input | cbBufLen | UDINT | Always 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.5 Parameter UPID read minimal value

Read the minimal value of the parameter specified by its UPID, and stores the result in the 4 bytes of the read_buffer.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 03h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + UPID |
| Input | pDstBuf | DWORD | ADR(read_buffer (4bytes)) |
| Input | cbBufLen | UDINT | Always 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.6 Parameter UPID read maximal value

Read the maximal value of the parameter specified by its UPID, and stores the result in the 4 bytes of the read_buffer.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 04h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + UPID |
| Input | pDstBuf | DWORD | ADR(read_buffer (4bytes)) |
| Input | cbBufLen | UDINT | Always 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.7 Parameter UPID read default value

Read the default value of the parameter specified by its UPID, and stores the result in the 4 bytes of the read_buffer.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 05h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + UPID |
| Input | pDstBuf | DWORD | ADR(read_buffer (4bytes)) |
| Input | cbBufLen | UDINT | Always 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.8 Parameter UPID write RAM & ROM value

Write the content of the write_buffer to the RAM and ROM value of the parameter specified by its UPID. The write_buffer can have a unique size of 4 bytes.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 06h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + UPID |
| Input | pSrcBuf | DWORD | ADR(write_buffer (4bytes)) |
| Input | cbBufLen | UDINT | Always 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.9 Parameter default OS SW instance

All parameters of the OS SW instance are set to their default value. The SDO response is given when the defaulting process is finished, this can last several seconds.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 07h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.10 Parameter default MC SW instance

All parameters of the MC SW instance are set to their default value. The SDO response is given when the defaulting process is finished, this can last several seconds.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 08h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.11 Parameter default Intf SW instance

All parameters of the interface SW instance are set to their default value. The SDO response is given when the defaulting process is finished, this can last several seconds.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 09h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.12 Parameter default Appl SW instance

All parameters of the application SW instance are set to their default value. The SDO response is given when the defaulting process is finished, this can last several seconds.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 0Ah (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.13 Reset device

This service resets the device.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 0Bh (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.14 Parameter default MC SW instance with immediate response

All parameters of the MC SW instance are set to their default value, the SDO response is given immediate. Take into account that the defaulting process last up to 10 seconds don't take other actions before this time is elapsed.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 18h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.15 Start read UPID List

Specify the SW layer by its start UPID of which the UPID list will be read out. The list contains all parameters and variables of the SW layer.

| FUNCTION_BLOCK FB_EcCoESdoWriteEx | | | |
|-----------------------------------|-----------------|------------|---|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AoE NetID |
| Input | nSlaveAddr | T_AmsPort | ADS Port |
| Input | nSubIndex | UDINT | 0024h (LinMot Service ID) |
| Input | nIndex | UDINT | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (4bytes))
Start UPID:
0000h: OS SW layer
1000h: MC SW layer
2000h: Intf SW layer
3000h: Appl SW layer |
| Input | cbBufLen | UDINT | Always 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bCompleteAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.16 Read next UPID List entry

Read the response state, UPID, address usage and ROM value of the parameter and the RAM value of the variables. The reading of the list doesn't stop at the end of a SW instance, only at the end of all instances.

| FUNCTION_BLOCK FB_EcCoESdoReadEx | | | |
|----------------------------------|-----------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AMS NetID |
| Input | nSlaveAddr | T_AmsPort | ADS Port |
| Input | nSubIndex | UDINT | 0025h (LinMot Service ID) |
| Input | nIndex | UDINT | 2000h |
| Input | pDstBuf | Struct | ADR(read_buffer (10bytes)) |
| Input | cbBufLen | UDINT | Always 10 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bCompleteAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

Response Data Structure

| Offset | Name | Type | Description |
|--------|---------------|-------|---|
| 0 | Res State | UINT | 0x0000: No error
0x00C5: Reading not initialized
0x00C6: No UPID found (finished) |
| 2 | UPID | UINT | UPID of Parameter Or Variable |
| 4 | Value | UDINT | Value of Parameter |
| 8 | Address usage | UINT | |

5.2.17 Start read modified UPID List

Specify the SW layer by its start UPID of which the UPID list will be read out. The list contains all parameters and variables of the SW layer.

| FUNCTION_BLOCK FB_EcCoESdoWriteEx | | | |
|-----------------------------------|------------|------------|---|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AoE NetID |
| Input | nSlaveAddr | T_AmsPort | ADS Port |
| Input | nSubIndex | UDINT | 0026h (LinMot Service ID) |
| Input | nIndex | UDINT | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (4bytes))
Start UPID:
0000h: OS SW layer
1000h: MC SW layer
2000h: Intf SW layer |

FUNCTION_BLOCK FB_EcCoESdoWriteEx

| Direction | Name | Type | Description |
|-----------|-----------------|-------|-----------------------------------|
| | | | 3000h: Appl SW layer |
| Input | cbBufLen | UDINT | Always 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bCompleteAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.18 Read next modified UPID List entry

Read the response state, UPID, address usage and ROM value of the next modified parameter. The reading of the list doesn't stop at the end of a SW instance, only at the end of all instances.

FUNCTION_BLOCK FB_EcCoESdoReadEx

| Direction | Name | Type | Description |
|-----------|-----------------|------------|--|
| Input | sNetId | T_AmsNetId | AMS NetID, in some cases it also gives AoE NetID |
| Input | nSlaveAddr | T_AmsPort | ADS Port, in some cases it gives UINT (address of slave) |
| Input | nSubIndex | UDINT | 0027h (LinMot Service ID) |
| Input | nIndex | UDINT | 2000h |
| Input | pDstBuf | Struct | ADR(read_buffer (10bytes)) |
| Input | cbBufLen | UDINT | Always 10 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bCompleteAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

Response Data Structure

| Offset | Name | Type | Description |
|--------|---------------|-------|---|
| 0 | Res State | UINT | 0x0000: No error
0x00C5: Reading not initialized
0x00C6: No UPID found (finished) - in this state the last UPID value is still received |
| 2 | UPID | UINT | UPID of Parameter Or Variable |
| 4 | Value | UDINT | Value of Parameter |
| 8 | Address usage | UINT | |

5.2.19 Stop MC and Application SW instances

This service stops the execution of the MC and application SW layers. This command should be used before configuring (writing to ROM values) of these instances.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 35h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.20 Start MC and Application SW instances

This service starts the execution of the MC and application SW layers. This command should be used after configuring (writing to ROM values) of these instances are finished.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 36h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.21 Curves copy curves from RAM to FLASH

This service copies the actual in the RAM defined curves to the FLASH memory, so they are available after power up. Use this command only with stopped MC SW!

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 40h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.22 Curves delete all curves in RAM

This service deletes all curves in the RAM.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 41h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.23 Curves start write curve in RAM

This service initiate the writing of a new curve in the RAM.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|---|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 50h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pSrcBuf | DWORD | ADR(write_buffer) |
| Input | cbBufLen | UDINT | 4 bytes: <ul style="list-style-type: none">• UINT: Info Data Size• UINT: Set Point Data Size |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.24 Curves write curve info block data in RAM

This service writes the curve info data block in the RAM, it has to be repeated until the whole info data block is written.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 53h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pSrcBuf | DWORD | ADR(write_buffer) |
| Input | cbBufLen | UDINT | 4 bytes data of curve info block |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.25 Curves write curve set point data in RAM

This service writes the curve setpoint data block in the RAM, it has to be repeated until all setpoints are written.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 53h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pSrcBuf | DWORD | ADR(write_buffer) |
| Input | cbBufLen | UDINT | 4 bytes of setpoint data |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.26 Curves read info and setpoint data block size in RAM

Read the status and size of the data blocks of the curve defined by its ID the data is stored in the read_buffer.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|--|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 60h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pDstBuf | DWORD | ADR(read_buffer (6bytes)) <ul style="list-style-type: none"> • UINT: Status • UINT: Info block size • UINT: Set point data block size |
| Input | cbBufLen | UDINT | 6 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.27 Curves read info block data in RAM

Read the info data block of the curve defined by its ID the 4 byte result is stored together with the read status in the 6 bytes of the read_buffer. This command has to be repeated until the whole info data block is read (status = 0).

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|---|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 61h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pDstBuf | DWORD | ADR(read_buffer (6bytes)) <ul style="list-style-type: none"> • UINT: Status • DWORD: data |
| Input | cbBufLen | UDINT | 6 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.28 Curves read set point data in RAM

Read the set point data block of the curve defined by its ID the 4 byte result is stored together with the read status in the 6 bytes of the read_buffer. This command has to be repeated until the whole set point data block is read (status = 0).

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|---|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 62h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pDstBuf | DWORD | ADR(read_buffer (6bytes)) <ul style="list-style-type: none"> • UINT: Status • DWORD: data |
| Input | cbBufLen | UDINT | 6 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.29 Read error counters

Read the number of logged errors and total occurred errors and stores them in the read buffer.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|---|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 70h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pDstBuf | DWORD | ADR(read_buffer (4bytes)) <ul style="list-style-type: none"> • UINT: Number of logged errors • UINT: Number of total errors |
| Input | cbBufLen | UDINT | 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.30 Read logged error item Code and instance

Read the error code of the specified (ID) logged error item..

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|--|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 71h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pDstBuf | DWORD | ADR(read_buffer (4bytes)) <ul style="list-style-type: none"> • UINT: Error code • UINT: Error instance |
| Input | cbBufLen | UDINT | 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.31 Read logged error item time low

Read the error time millisecond part of the specified (ID) logged error item.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|--|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 72h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pDstBuf | DWORD | ADR(read_buffer (4bytes))
• DINT: Error time [ms] |
| Input | cbBufLen | UDINT | 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.32 Read logged error item time high

Read the error time hours part of the specified (ID) logged error item..

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|---|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 73h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pDstBuf | DWORD | ADR(read_buffer (4bytes))
• DINT: Error time [h] |
| Input | cbBufLen | UDINT | 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.33 Read error short text

Read the short text of an error defined by its error code, for each stringlet (4 characters) a service number 74h..7Bh is defined.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|---|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 74h (LinMot Sdo Service ID) + stringlet Count 0..7) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pDstBuf | DWORD | ADR(read_buffer (4bytes))
• 4 characters of error short text |
| Input | cbBufLen | UDINT | 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.34 Command Table copy entries from RAM to FLASH

This service copies the actual in the RAM defined Command Table entries to the FLASH memory so they are available after power up. Use this command only with stopped MC SW!

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 80h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.35 Command Table delete all entries in RAM

This service deletes all Command table entries in the RAM.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 81h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.36 Command Table delete entry in RAM

This service delete a single Command Table entry defined by its ID in the RAM.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 82h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pSrcBuf | DWORD | ADR(write_buffer (0 bytes)) |
| Input | cbBufLen | UDINT | 0 bytes (4 bytes also accepted) |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.37 Command Table start write entry in RAM

This service initiate the writing of a new Command Table entry in the RAM.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|--------------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 83h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pSrcBuf | DWORD | ADR(write_buffer) |
| Input | cbBufLen | UDINT | 4 bytes:
• UDINT: Entry Data Size |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.38 Command Table write entry data in RAM

This service writes the Command Table data block in the RAM.

| FUNCTION_BLOCK: FB_EcCoeSdoWriteEx | | | |
|------------------------------------|--------------|------------|-----------------------------------|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 84h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pSrcBuf | DWORD | ADR(write_buffer) |
| Input | cbBufLen | UDINT | 4 bytes of entry data |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.39 Command Table entry data size in RAM

Read the the entry size of the Command Table entry specified by its ID, and stores the result in the 6 bytes of the read_buffer.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|--|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 85h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pDstBuf | DWORD | ADR(read_buffer (6bytes))
• UINT: Status
• UDINT: entry size |
| Input | cbBufLen | UDINT | 6 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.40 Command Table read entry data in RAM

Read the entry size of the Command Table entry specified by its ID, and stores the result in the 6 bytes of the read_buffer.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|--|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 85h (LinMot Sdo Service ID) |
| Input | nIndex | WORD | 2000h + ID |
| Input | pDstBuf | DWORD | ADR(read_buffer (6bytes))
• UINT: Status
• UDINT: entry size |
| Input | cbBufLen | UDINT | 6 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

5.2.41 Command Table read presence list

Read the Command Table entry list defined by its subindex-ID, and stores the result in the 4 bytes of the read_buffer. A zero of the corresponding bit means command table entry is present, a one means the corresponding entry doesn't exist.

| FUNCTION_BLOCK: FB_EcCoeSdoReadEx | | | |
|-----------------------------------|--------------|------------|--|
| Direction | Name | Type | Description |
| Input | sNetId | T_AmsNetId | AmsNetId of master |
| Input | nSlaveAddr | UINT | Address of slave |
| Input | nSubIndex | Byte | 87h + ID (LinMot Sdo Service ID)
ID = 0: entries 0..31
ID = 1: entries 32..63
ID = 2: entries 64..95
ID = 3: entries 96..127
ID = 4: entries 128..159
ID = 5: entries 160..191
ID = 6: entries 192..223
ID = 7: entries 224..225 |
| Input | nIndex | WORD | 2000h |
| Input | pDstBuf | DWORD | ADR(read_buffer (4bytes))
- DWORD: presence list, 0 means entry exists |
| Input | cbBufLen | UDINT | 4 bytes |
| Input | bExecute | BOOL | Rising edge starts writing |
| Input | tTimeout | TIME | Timeout value |
| Input | bComplAccess | BOOL | FALSE |
| Output | bBusy | BOOL | Indicates reading active/finished |
| Output | bError | BOOL | Indicates reading error |
| Output | nErrId | UDINT | Error ID |

6 EtherCAT CiA402 Parameters

6.1 Parameters



Attention: The EtherCAT CiA402 Interface has an additional parameter tree branch (Parameters → EtherCAT CiA402), which can be configured with the distributed LinMot-Talk software.

With these parameters, the EtherCAT interface can be enabled or disabled.

The LinMot-Talk software can be downloaded from <http://www.linmot.com> under the section Download, Software, LinMot Talk.

6.1.1 EtherCAT CiA402/Dis-/Enable

With the Dis-/Enable parameter the LinMot Servo Drive can be run without the Ethernet EtherCAT Interface going online. So in a first step the system can be configured and run without any bus connection.

ETHERCAT/Dis-/Enable

| | |
|---------|--|
| Disable | Servo Drive runs without ETHERCAT. |
| Enable | Servo Drive runs with ETHERCAT connection. |



Attention: If the ETHERCAT Interface is disabled, the integrated ETHERCAT-ASIC rests in reset state! No messages will be sent to other devices connected to the ETHERCAT-Network via the servo drive.

6.1.2 EtherCAT CiA402/Station Alias/Alias Address Source

With this parameter the station alias address source is defined.



Attention: If a station alias address is defined in the ET1100 Eeprom (could be programmed from the master over the Network), this alias address is taken.

ETHERCAT/Station Alias/Alias Address Source

| | |
|------------------------------------|--|
| None | No station alias address is generated |
| ID Switches | The ID switches defines the station alias address |
| ID Switches + Parameter | The station alias address is build out of the ID-Switch value added with the parameter value (typ. Offset) |
| RT MAC | The lowest 2 bytes of the device MAC address are used as station alias address |
| Parameter | The Station alias address parameter value defines the Alias Address |
| Masked RT MAC and Parameter | The station alias address is defined by the masked parameter ored with the RT MAC masked with the inverse mask |

6.1.3 EtherCAT CiA402/Station Alias/Alias Address Parameter

This is the parameter value of the station alias address.

6.1.4 EtherCAT CiA402/Station Alias/Alias Address Parameter Mask

Mask value for the parameter value of the station alias address.

6.1.5 EtherCAT CiA402/NC Configuration/Velocity Scale Numerator /Denominator

This two parameters are taken to Scale the PDO Value of "Target velocity" (Index 0x60FF) to the Drive Resolution which is [1µm/s]. The Scaling factor is Velocity Scale Numerator divided by Velocity Scale Denominator.

For the Beckhoff this factor could be set to 1 (as the default value is 1/1), if adapted as described chapter 2.2 in the master.

For Omron PLC's this factor is typically 0.1 → Velocity Scale Numerator = 1 and Velocity Scale Denominator = 10.

6.1.6 EtherCAT CiA402/NC Configuration/Operation Mode 10 Config

| ETHERCAT/NC Configuration/Operation Mode 10 Config | |
|--|---|
| Current Command Mode | In Operation Mode 10 the current command mode is activated, the setpoint is given directly as current [mA]. |
| Force/Torque Control Mode | In Operation Mode 10 the current command mode is activated, the setpoint is given relative, 5000 corresponds to the maximal force/torque. |
| Closed Loop Force/Torque Control Mode | In Operation Mode 10 the closed loop force/torque control mode is activated, the setpoint is given relative, 5000 corresponds to the maximal force/torque. |
| Closed Loop Force/Torque Control Mode Abs | In Operation Mode 10 the closed loop force/torque control mode is activated, the setpoint is given absolute with 0.1N resolution as Target Force (UPID 1EA0h) and 1E-6Nm resolution as target torque. |

This parameter is used for the when Output PDO modules 0x1604 or 0x1614 are used.

6.1.7 EtherCAT CiA402/Connection Timeout/Timeout Behavior

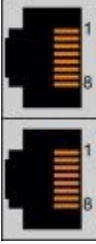
With this parameter the drive behavior on an Connection timeout could be set. This parameter is also represented in the profile parameter with index 0x6007.

| ETHERCAT/Conection Timeout/Timeout Behavior | |
|---|---|
| Ignore | Nothing happens if an IO timeout occurs. |
| Error with Disable Voltage | Drive goes to Error State and the Voltage is disabled immediately when the IO timeout occurs. |
| Error with Quick Stop | Drive goes to Error State before the Voltage is disabled a Quick Stop is performed, when the IO timeout occurs. |
| Error with Go To Pos | Drive goes to Error State before the Voltage is disabled a Go To Position is performed, when the IO timeout occurs. |

7 Connecting to the EtherCAT Network

7.1 Pin Assignment of the Connectors X17-X18

The ETHERCAT connector is a standard RJ45 female connector with a pin assignment as defined by EIA/TIA T568B:

| X17 – X18 | ETHERCAT Connector | | |
|---|--|-----------------|-----------------------|
| | Pin | Wire color code | Assignment 100BASE-TX |
|  | 1 | WHT/ORG | Rx+ |
| | 2 | ORG | Rx- |
| | 3 | WHT/GRN | Tx+ |
| | 4 | BLU | - |
| | 5 | WHT/BLU | - |
| | 6 | GRN | Tx- |
| | 7 | WHT/BRN | - |
| | 8 | BRN | - |
| | case | - | - |
| RJ-45 | Use standard patch cables (twisted pair, S/UTP, AWG26) for wiring. This type of cable is usually referred to as a "Cat5e-Cable". | | |

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