LinMot®

sercos

the automation bus

Third generation sercos bus interface for SG5

User Manual

This document applies to the following devices:
E1250-SC-xx
E1450-SC-xx
B8050-ML-SC
(with sercos Interface SW installed)

Note:
The information in this documentation reflects the stage of development at the time of press and is therefore without obligation. NTI AG reserves itself the right to make changes at any time and without notice to reflect further technical advance or product improvement.

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1. System Overview

The LinMot E1250-SC-xx, E1450-SC-xx and B8050-ML-SC devices are sercos slaves with the following parameters:

Device Property	Value
sercos generation	Third generation
sercos version	sercos III V1.1.2
Supported profiles and telegram types	FSP_DRIVE, FSP_IO[1]
Minimal sercos cycle time	250 µs
Vendor Device ID	'0150-1764' (E1250-SC-UC) '0150-1785' (E1450-SC-QN) '0150-1881' (B8050-ML-SC)
Vendor Code	342 (0156h)

For further information on sercos please visit: http://www.sercos.org/

Note: The LinMot sercos drives always operate in position control mode when using the FSP-DRIVE profile, thus it is NOT recommended to use additional functionality like the command table, motion commands triggered by I/O etc., as this can lead to unpredictable system behaviour. When using the FSP-IO profile everything can be used in combination, as the user has complete control over the system.

2. PLC Compatibility

		E1250-SC-xx	E1450-SC-xx	B8050-ML-SC
ELAU PacDrive 3				
FSP-IO	(with LinMot drive interface)	x	x	x
FSP-DRIVE	(with sercos drive profile)	●	●	x
Bosch Rexroth IndraControl / IndraMotion				
FSP-IO	(with LinMot drive interface)	●	●	●
FSP-DRIVE	(with sercos drive profile)	●	●	x
CoDeSys V3 (with AUTOMATA SIII-Mastercard)				
FSP-IO	(with LinMot drive interface)	x	x	x
FSP-DRIVE	(with sercos drive profile)	x	x	x
Schleicher Electronic XCx				
FSP-IO	(with LinMot drive interface)	?	?	?
FSP-DRIVE	(with sercos drive profile)	?	?	?
KEBA sercos communication modules				
FSP-IO	(with LinMot drive interface)	?	?	?
FSP-DRIVE	(with sercos drive profile)	?	?	?
Hilscher sercos PCI master cards				
FSP-IO	(with LinMot drive interface)	?	?	?
FSP-DRIVE	(with sercos drive profile)	?	?	?

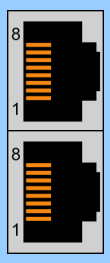
●: Working, x: Not Working, ?: Untested

1 See chapter „5 Supported Profiles and Telegram Types„ for details

3. Connecting to the sercos Network

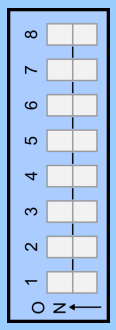
3.1 Pin Assignment of the Connectors X17-X18

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

X17 – X18	sercos connector		
	**Pin**	**Wire color code**	**Assignment 100BASE-TX**
	1 2 3 4 5 6 7 8 case	WHT/ORG ORG WHT/GRN BLU WHT/BLU GRN WHT/BRN BRN -	Tx+ Tx- Rx+ - - Rx- - - -
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”.		

3.2 Setting the sercos Address

The sercos address is set via the two ID-switches S1 and S2, where S1 sets the high digit and S2 the low digit. The address can have a value between 1 (01h) and 255 (FFh).

S1, S2:		Address Selectors		
E12x0 V1	E12x0 V2, E14x0			
		S1	Bus ID High	(0h…Fh)
		S2	Bus ID Low	(0h…Fh)

Note: The sercos address has no use with some identification modes like topology based addressing. Consult the manuals of your sercos master for further details.

4. sercos Parameters and Variables in LinMot-Talk

4.1 Parameters

The sercos interface has its own parameter tree branch (Parameters→sercos), which can be configured with the distributed LinMot-Talk software.
The LinMot-Talk software can be downloaded from http://www.linmot.com from the section “Download → Software and Manuals”.

sercos\ Application Type (S-0-1302.0.3)
This parameter contains the type of the drive application (e.g., main linear drive, pusher 001, X axis, etc.) The user can write this parameter if desired. It is used for identification purposes.

sercos\ Application Type (S-0-1302.0.3)		Default Value
String	Device runs without sercos interface.	'LinMot Axis'

sercos\ Dis-/Enable
With the Dis-/Enable parameter the LinMot device can be run without the sercos bus going online. So in a first step the system can be configured and run without any bus connection.

sercos\ Dis-/Enable		Default Value
Disable	Device runs without sercos interface.	-
Enable	Device runs with sercos interface.	X

IMPORTANT: If the sercos bus interface is disabled, the integrated communication hardware is not powered! No messages will be sent to other devices connected to the sercos network via the LinMot device.

sercos\ sercos Address
In this section the sercos address can be configured.

sercos\ sercos Address		Default Value
sercos Address Source Select	Shows which source is selected to provide the sercos address.	By ID Switches S1 and S2
sercos Address Parameter Value	Value of the sercos address if ‘By Parameter’ is selected.	63

sercos\ sercos Address\ sercos Address Source Select
In this section the source of the sercos address can be configured.

***sercos\ sercos Address\ sercos Address* Source Select**		**Default Value**
By ID Switches S1 and S2	The sercos address is determined by the switches S1 (ID HIGH) and S2 (ID LOW).	X
By Parameter	The sercos address is determined by the parameter 'sercos Address Parameter Value' in the LinMot-Talk software.	-

***sercos\ sercos Homing Mode*[2]**
In this section the sercos homing mode can be configured.

sercos\ sercos Homing Mode		**Default Value**
sercos Homing Mode Select	Shows which homing mode is selected.	Initiated by user (PLC or I/O)

sercos\ sercos Homing Mode\ sercos Homing Mode Select
In this section the sercos homing mode can be configured.

sercos\ sercos Homing Mode\ sercos Homing Mode Select		**Default Value**
Initiated by user (PLC or I/O)	The user has to initiate the homing procedure either via digital I/Os or via PLC commands.	X
AutoHoming	The drive automatically initiates the configured homing procedure as soon as it is enabled via the sercos drive control word.	-

Automatic homing can damage equipment and/or injure people.
The user has to make sure that homing is safely possible
(i.e. no mechanical obstruction) when enabling the drive.

2 This parameter is only valid and in effect when the FSP_DRIVE profile is active.

4.2 Variables

Name	Type	Definition	Validity (FSP_IO, FSP_Drive)
sercos Address	UInt16	Current sercos address	Both
sercos Topology Address	UInt16	Current sercos topology address	Both
sercos Communication Phase	UInt16 Enum	Current sercos CP (NRT, CP0, CP1, CP2, CP3, CP4)	Both
Communication Cycle Time (S-0-1002)	UInt32	sercos cycle time in milliseconds	Both
IO Control (S-0-1500.0.01)	UInt16	sercos IO control word	FSP_IO
IO Status (S-0-1500.0.02)	UInt16	sercos IO status word	FSP_IO
Drive Control (S-0-0134)	UInt16	sercos drive control word	FSP_Drive
Drive Status (S-0-0135)	UInt16	sercos drive status word	FSP_Drive
Position Command Value (S-0-0047)	SInt32	Demand position	FSP_Drive
Position Feedback Value (S-0-0051)	SInt32	Actual position	FSP_Drive
Class 1 diagnostic (S-0-0011)	UInt32	sercos errors	Both
Manufacturer Class 1 diagnostic (S-0-0129)	UInt32	Manufacturer specific erros	Both
Class 2 diagnostic (S-0-0012)	UInt32	sercos warnings	Both
Manufacturer Class 2 diagnostic (S-0-0181)	UInt32	Manufacturer specific warnings	Both
Config Module Control	UInt16	Control word of the config module	Both
Config Module Index In	UInt16	Input index of the config module	Both
Config Module Value In	UInt32	Input value of the config module	Both
Config Module Status	UInt16	Status word of the config module	Both
Config Module Index Out	UInt16	Output index of the config module	Both
Config Module Value Out	UInt32	Output value of the config module	Both

5. Supported Profiles and Telegram Types

The E1250-SC-xx and E1450-SC-xx can be operated either as standard sercos drives utilizing the sercos drive profile or with the sercos IO profile using a LinMot custom drive interface for drive communication.

5.1 Function Specific Profile Drive (FSP_Drive)

5.1.1 Telegram Types

LinMot drives support the sercos standard telegram 4 in basic operation mode 3 (Position control using position feedback value 1 (motor feedback)).
The IDN S-0-0015 configures the telegram type where bits 2-0 with the value '100' indicate the use of standard telegram 4.

Standard telegram 4 (Telegram Type 4)	
MDT	S-0-0134: Drive control S-0-0047: Position command value
AT	S-0-0135: Drive status S-0-0051: Position feedback value 1 (motor feedback)

Configuration with an IDN list is also possible (telegram type 7).

Configuration with an IDN list (Telegram Type 7)	
MDT	S-0-0134: Drive control S-0-0047: Position command value P-0-0210: LinMot Configuration Module Control P-0-0211: LinMot Configuration Module Index In P-0-0212: LinMot Configuration Module Value In
AT	S-0-0135: Drive status S-0-0051: Position feedback value 1 (motor feedback) P-0-0100: LinMot StatusWord P-0-0101: LinMot StateVar P-0-0220: LinMot Configuration Module Status P-0-0221: LinMot Configuration Module Index Out P-0-0222: LinMot Configuration Module Value Out

Note: The order of the list's objects and its content have to be exactly as stated in the table above to work properly.

Note: For more information on the configuration module see chapter 8 Realtime IO Configuration Module.

5.2 Function Specific Profile IO (FSP_IO)

5.2.1 Drive Interface (E1250-SC-xx and E1450-SC-xx)

When using the E1250-SC-xx or the E1450-SC-xx with the function specific IO profile, the following interface is configured as cyclic real-time data:

Drive Interface		Data Type	UPID
MDT	ControlWord	UInt16	1D52h
	MC Cmd Header	UInt16	1DB0h
	MC Cmd Parameter Word 0	UInt16	1E40h (low 16Bit)
	MC Cmd Parameter Word 1	UInt16	1E40h (high 16Bit)
	MC Cmd Parameter Word 2	UInt16	1E41h (low 16Bit)
	MC Cmd Parameter Word 3	UInt16	1E41h (high 16Bit)
	MC Cmd Parameter Word 4	UInt16	1E42h (low 16Bit)
	MC Cmd Parameter Word 5	UInt16	1E42h (high 16Bit)
	MC Cmd Parameter Word 6	UInt16	1E43h (low 16Bit)
	MC Cmd Parameter Word 7	UInt16	1E43h (high 16Bit)
	MC Cmd Parameter Word 8	UInt16	1E44h (low 16Bit)
	MC Cmd Parameter Word 9	UInt16	1E44h (high 16Bit)
	Config Module Control	UInt16	211Bh
	Config Module Index Out	UInt16	211Ch
	Config Module Value Out	UInt32	211Dh
	Reserved	UInt32	-
AT	StateVar	UInt16	1B62h
	StatusWord	UInt16	1D51h
	WarnWord	UInt16	1D8Eh
	Config Module Status	UInt16	211Eh
	Config Module Index In	UInt16	211Fh
	Config Module Value In	UInt32	2120h
	DemandPosition	SInt32	1B8Ah
	ActualPosition	SInt32	1B8Dh
	DemandCurrent	SInt32	1B93h
	Reserved	UInt32	-

With this interface, an axis can be completely controlled and operated.

For a detailed description on how the LinMot motion command interface is used, how the LinMot state machine works etc., please consult the follwing user manuals:

- “Usermanual_MotionCtrlSW_SG5”
- “Controller_Configuration_over_Fieldbus_SG5”

5.2.2 Drive Interface (B8050-ML-SC)

When using the B8050-ML-SC, the following interface is configured as cyclic real-time data per axis:

Drive Interface		Data Type
MDT	Axis_x_TX_ControlWord	UInt16
	Axis_x_TX_MC_Header	UInt16
	Axis_x_TX_MC_Par_Word_0	UInt16
	Axis_x_TX_MC_Par_Word_1	UInt16
	Axis_x_TX_MC_Par_Word_2	UInt16
	Axis_x_TX_MC_Par_Word_3	UInt16
	Axis_x_TX_MC_Par_Word_4	UInt16
	Axis_x_TX_MC_Par_Word_5	UInt16
	Axis_x_TX_MC_Par_Word_6	UInt16
	Axis_x_TX_MC_Par_Word_7	UInt16
	Axis_x_TX_MC_Par_Word_8	UInt16
	Axis_x_TX_MC_Par_Word_9	UInt16
	Axis_x_TX_Cfg_Module_Control	UInt16
	Axis_x_TX_Cfg_Module_Index_Out	UInt16
	Axis_x_TX_Cfg_Module_Value_Out	UInt32
AT	Axis_x_RX_StateVar	UInt16
	Axis_x_RX_StatusWord	UInt16
	Axis_x_RX_WarnWord	UInt16
	Axis_x_RX_DemandCurrent	SInt16
	Axis_x_RX_ActualPosition	SInt32
	Axis_x_RX_DemandPosition	SInt32
	Axis_x_RX_Reserved_Word_1	UInt16
	Axis_x_RX_Reserved_Word_2	UInt16
	Axis_x_RX_Reserved_Word_3	UInt16
	Axis_x_RX_Reserved_Word_4	UInt16
	Axis_x_RX_Cfg_Module_Status	UInt16
	Axis_x_RX_Cfg_Module_Index_In	UInt16
	Axis_x_RX_Cfg_Module_Value_In	UInt32

With this interface, an axis can be completely controlled and operated.

For a detailed description on how the LinMot motion command interface is used, how the LinMot state machine works etc., please consult the follwing user manuals:

- "Usermanual_MotionCtrlSW"
- "Controller_Configuration_over_Fieldbus_SG4"

6. Mapping of Errors and Warnings to C1D and C2D

6.1 Class 1 diagnostic C1D (S-0-0011)

The IDN S-0-0129 (Manufacturer class 1 diagnostic) always contains the LinMot error number of the most recent error. If a LinMot error is mapped to one of the C1D bits, this bit is set in case of that error. If another error occurs, bit 15 is set and the error code can be read via IDN S-0-0129.

C1D Bit	sercos C1D errors	LinMot error description	LinMot error	Drive (E12x0, E14x0)
Bit 15	manufacturer-specific error	See S-0-0129	-	Both
Bit 14	reserved	-	-	Both
Bit 13	over travel limit is exceeded	Err: Min Pos Undershot Err: Max Pos Overshot	0007h 0008h	Both Both
Bit 12	reserved	-	-	Both
Bit 11	excessive position deviation	Err: Pos Lag Always Too Big Err: Pos Lag Standing Too Big	000Bh 000Ch	Both Both
Bit 10	power supply phase error	-	-	Both
Bit 9	under voltage error	Err: X1 Pwr Voltage Too Low	0003h	Both
Bit 8	over voltage error	Err: X1 Pwr Voltage Too High	0004h	Both
Bit 7	over current error	Fatal Err: X1 Pwr Over Current	000Dh	E12x0
Bit 6	error in the „commutation“ system	Fatal Err: X13 Signals Missing Fatal Err: X3 Hall Sig Missing	000Ah 0021h	Both Both
Bit 5	feedback error	Err: Sensor Alarm On X13	0025h	Both
Bit 4	control voltage error	Err: X4 Logic Supply Too Low Err: X4 Logic Supply Too High	0001h 0002h	Both Both
Bit 3	cooling error shut-down	Err: Fan Driver Error	0043h	Both
Bit 2	motor over temperature shut-down	Err: Motor Hot Sensor	0020h	Both
Bit 1	amplifier over temperature shut-down	Err: Controller Ph1+ Too Hot Err: Power Module Too Hot Err: Controller Ph1- Too Hot Err: Motor Supply Too Hot Err: Controller Ph2+ Too Hot Err: Sensor Supply Too Hot Err: Controller Ph2- Too Hot Err: Controller Pwr Too Hot Err: Controller X3 Too Hot Err: Controller Core Too Hot	0010h 0010h 0011h 0011h 0012h 0012h 0013h 0014h 0016h 0017h	E12x0 E14x0 E12x0 E14x0 E12x0 E14x0 E12x0 E12x0 E12x0 Both
Bit 0	overload shut-down	Err: Motor Short Time Overload	0023h	Both

Note: If an error is fatal, the error cannot be acknowledged. In that case, power cycling is required to clear the error.

6.2 Class 2 diagnostic C2D (S-0-0012)

The IDN S-0-0181 (Manufacturer class 2 diagnostic) always contains the LinMot WarnWord. If a bit of the LinMot WarnWord is set, that is not matched to a sercos C2D warning , bit 15 is set to indicate a manufacturer specific warning.

C2D Bit	sercos C2D warning	LinMot warning	Bit of LinMot WarnWord
Bit 15	Manufacturer specific warning	See S-0-0181	-
Bit 14	Reserved	-	-
Bit 13	Reserved	-	-
Bit 12	Communication warning	-	-
Bit 11	Excessive velocity deviation	-	-
Bit 10	Reserved	-	-
Bit 9	Undervoltage warning (bus voltage)	Motor Supply Voltage Low	2
Bit 8	Reserved	-	-
Bit 7	Reserved	-	-
Bit 6	Reserved	-	-
Bit 5	Reserved	-	-
Bit 4	Reserved	-	-
Bit 3	cooling error warning	-	-
Bit 2	motor over temperature warning	Motor Hot Sensor	0
Bit 1	amplifier over temperature warning	Controller Hot	6
Bit 0	overload warning	Motor Short Time Overload	1

7. Read/Write UPIDs via IDNs

Every parameter and variable in a LinMot system has its own UPID (Unique Parameter ID).
Every UPID is mapped to its own manufacturer specific IDN to access it via the sercos service channel.

UPIDs are mapped according to the following table:

UPID	IDN
0xHBLB	P-0-0000.HB_{dec}.LB_{dec} (0xHBLB8000)

HB: High Byte (hexadecimal), HB_{dec}: High Byte (decimal)
LB: Low Byte (hexadecimal), LB_{dec}: Low Byte (decimal)

Supported UPID functions via IDN access over the sercos service channel:

UPID Access	IDN Access
Read UPID value (RAM value)	Read IDN Element 7: structure of operation data
Write UPID value (RAM value)	Write IDN Element 7: structure of operation data
Get minimum value of UPID	Read IDN Element 5: structure of minimum value
Get maximum value of UPID	Read IDN Element 6: structure of maximum value

8. Realtime IO Configuration Module

This software module can be used to access parameters by UPID, setting their values to default, read the error log and much more.
For a detailed description of the whole functionality, please refer to the manual "Controller_Configuration_over_Fieldbus_SG5".

The following IDNs are used for the configuration module:

IDN	Description	Data Direction
P-0-0210	LinMot Config Module Control	PLC → Drive
P-0-0211	LinMot Config Module Index In	PLC → Drive
P-0-0212	LinMot Config Module Value In	PLC → Drive
P-0-0220	LinMot Config Module Status	Drive → PLC
P-0-0221	LinMot Config Module Index Out	Drive → PLC
P-0-0222	LinMot Config Module Value Out	Drive → PLC

These IDNs are accessible over the sercos service channel or they can be directly mapped to the real-time process data (see chapter "5.1.1 Telegram Types" and "10.3.2 Configuration with an IDN List").

Example: Read the RAM value of a parameter

1. Write UPID of parameter to IDN P-0-0211
2. Write Config Module Control (Command: 110xh) to IDN P-0-0210
3. Read IDN P-0-0222 to get the RAM value of the parameter

Example: Write the RAM value of a parameter

1. Write UPID of parameter to IDN P-0-0211
2. Write value of parameter to IDN P-0-0212
3. Write Config Module Control (Command: 130xh) to IDN P-0-0210

9. Drive Homing

The homing mode can be configured with the LinMot-Talk software. All the different possibilities to start the homing procedure will trigger this configured homing mode.

Even though it is possible to use a LinMot motor without being referenced to the machine zero point, it is strongly advised not to, as this can lead to unpredictable sytem behaviour.

It is recommended to use the drive controlled homing procedure command (IDN S-0-0148) when possible.

9.1 Using the Drive Controlled Homing Procedure Command

Relevant parameters:

IDN	Description
S-0-0147	Homing Parameter
S-0-0148	Drive Controlled Homing Procedure Command

By executing IDN S-0-0148 as a procedure command, the drive controlled homing is started. The procedure can only be executed successfully when the drive is already enabled (Drive Control Word (S-0-0134) = E000h).
Executing this command while the drive is not enabled will result in an error.

Note: Configured homing modes by IDN S-0-0147 will be ignored, the drive always executes the homing procedure which was configured with LinMot-Talk.
The start inhibitor will be overridden automatically if necessary.

Note: Using this procedure function command is only possible when using the drive with the FSP-DRIVE profile.

9.2 Using the LinMot Control-/StatusWords

When using the FSP-IO profile, all of the necessary parameters are part of the real-time process data.
When using the FSP-DRIVE profile, all of the necessary parameters can be accessed via the sercos service channel.

Relevant parameters:

UPID	Description	IDN
1D52h	LinMot ControlWord (accessed via interface)	P-0-0000.29.82 (1D528000h)
1D51h	LinMot StatusWord	P-0-0000.29.81 (1D518000h)
1B62h	LinMot StateVar	P-0-0000.27.98 (1B628000h)

1. Check if the drive is in operational state “Operation Enabled” (StateVar = 08xxh)

2. If drive is in state 00xxh (“Not ready to Switch On”), toggle bit 0 of the LinMot ControlWord to override the start inhibitor.

3. Read LinMot ControlWord.

4. Modify read value by setting bit 11 (Home bit).

5. Initiate the homing procedure by writing the LinMot ControlWord back to the drive.

6. Check if homing is finished by reading the “Homed” bit (bit 11 of the LinMot StatusWord).

7. Reset bit 11 of the LinMot ControlWord.

10. Commissioning with ELAU PacDrive 3 controllers

The LinMot E1250-SC-xx and E1450-SC-xx drives can be integrated in an ELAU PacDrive 3 system with the use of the SercDrv object. This object uses the FSP_DRIVE profile.
For additional information consult the corresponding manuals from ELAU.
This chapter describes how to configure this object for use with a LinMot system.
The subchapters cover the different parameter groups as they are presented in the EPAS configuration window for the SercDrv object.

10.1 General

Parameter	Value
Motor peak current	Maximum input current of the motor.
Controller peak current	Maximum output current the controller is able to deliver.

The required values can be found in the LinMot data book.

Example:
Linear guide LM01-23x80/160 with a mass of 610g and 749g of additional load mass
→ Input value for motor peak current: 4000 [mA] (@ 72VDC)
→ Input value for controller peak current: 32000 [mA]

10.2 Motor/Mechanic

As the LinMot motors are linear systems, the parameters of the SercDrv rotative system have to be chosen in a way that approximately maps this rotative system to a linear one.
With the following values for the parameters, a unit of position
(= FeedbackResolution / FeedConstant) is equivalent to 0,1mm:

Parameter	Value	Unit
GearIn	1	-
GearOut	1	-
FeedConstant	100	[Units/Revolution]
FeedbackResolution	100000	Inc. (=0,1[µm])
MaxRPM	See chapter 10.2.1	[1/min]
ModuloValue	0	Inc. (=0,1[µm])
J total	See chapter 10.2.2	[kg*cm^2]
Torque Constant	See chapter 10.2.3	[0,001*Nm/A]
Direction	right	-

10.2.1 MaxRPM

This value has direct influence on the maximum velocity. It has to be set in a way, that the resulting maximum velocity matches the value in the LinMot data book for max. speed.

Example:
Linear guide LM01-23x80/160 with a mass of 610[g] and 749[g] of additional load mass
→ Max. Speed (@72VDC) : 6,0 [m/s] = 360 [m/min]
→ Input value for MaxRPM: 360 [m/min] / 'FeedbackResolution' =
360 [m/min] / 10 [mm] = 36000 [1/min]

10.2.2 J total

As the moment of inertia *J* is not applicable in a linear system, one has to input the total moving mass of the linear system in [kg], considering the similarities of the following equations:

Rotational movement	
$M = J \cdot \alpha$	(M:Torque, J: moment of inertia, α: angular acceleration)

Linear movement	
$F = m \cdot a$	(F: force, m: mass, a: acceleration)

Example:
Linear guide LM01-23x80/160 with a mass of 610[g] and 749[g] of additional load mass
→ Total moving mass: 610[g] + 749[g] = 1359[g] = 1,359 [kg]
→ Input value for J total: 1,359 [kg*cm^2]

10.2.3 Torque constant

For linear motors, the force constant of the linear motor (unit: [N/A]) is used instead of the torque constant, since a torque constant is not applicable for a linear system.

Example:
Linear guide LM01-23x80/160 with a mass of 610[g] and 749[g] of additional load mass
→ Force constant: 11[N/A]
→ Input value for torque constant: 11000 [0,001*Nm/A]

10.3 Realtimechannel

10.3.1 Standard Telegram 4

Parameter	Value
TelegramType	4
PrimaryOperationMode	3
ConfigurationListAT	-
ConfigurationListATLength	2
PositionFeedbackValueOffset	0
ConfigurationListMDT	-
ConfigurationListMDTLength	2
PositionCommandValueOffset	0

10.3.2 Configuration with an IDN List

If the Realtimechannel is configured with a list of IDNs the LinMot StatusWord, StateVar and the Realtime IO Configuration Module (see chapter “8 Realtime IO Configuration Module”) can be mapped directly as part of the real-time process data.

Parameter	Value
TelegramType	7
PrimaryOperationMode	3
ConfigurationListAT	'S-0-0047.0.0;P-0-0100.0.0;P-0-0101.0.0;P-0-0220.0.0; P-0-0221.0.0;P-0-0222.0.0'
ConfigurationListATLength	8
PositionFeedbackValueOffset	0
ConfigurationListMDT	'S-0-0051.0.0;P-0-0210.0.0;P-0-0211.0.0;P-0-0212.0.0'
ConfigurationListMDTLength	6
PositionCommandValueOffset	0

Note: The order of the list's objects and its content have to be exactly as stated in the table above to work properly.

10.4 Identification

Identification of the LinMot drive is possible with all modes (0-4).

Vendor Information	
VendorCode	342 (0156h)
VendorDeviceID	'0150-1764' (E1250-SC-UC) '0150-1785' (E1450-SC-QN)

10.5 Code examples

This chapter provides sample code snippets in structured text for use with a PacDrive 3 system.

10.5.1 Homing

If StartHoming_PFC is set to 1, the homing procedure will be executed:

```
PROGRAM SR_Main
VAR
        i_stAxisId := DRV_SercDrv.stLogicalAddress;
        IDNDataOUT: DWORD;
        StartHoming_PFC: BOOL := 0;
        RetVAL: DINT;

END_VAR

...
// Start Homing via PFC
IF StartHoming_PFC THEN

        FC_ControllerEnableSet(i_stAxisId);

        RetVAL := FC_SercosWriteServiceData(
                i_stAxisId,
                148,
                7,
                ADR(IDNDataOUT),  // The Value of IDNDataOUT is not of importance and can be of arbitrary value
                4);

        StartHoming_PFC := 0;

END_IF
…
```

10.5.2 Write UPID

If StartWriteIDN is set to 1, the UPID will be written once:

```
PROGRAM SR_Main
VAR
        StartWriteIDN: BOOL := 0;
        RetVAL: DINT;
        i_stAxisId := DRV_SercDrv.stLogicalAddress;
        IDN: DWORD := 16#13A68000; // UPID 13A6h (Maximal Current)
        IDNDataOUT: DWORD := 3000; // Set Maximal Current to 3A
        NumBytetoWrite: WORD := 4; // write 4 bytes of data

END_VAR

...
// WriteIDN
IF StartWriteIDN THEN

        RetVAL:=FC_SercosWriteServiceData(
                i_stAxisId,
                IDN,
                5,
                ADR(IDNDataOUT),
                NumBytetoWrite);

                StartWriteIDN := 0;

END_IF
…
```

10.5.3 Read UPID

If StartReadIDN is set to 1, the UPID will be read once:

```
PROGRAM SR_Main
VAR
        StartReadIDN: BOOL := 0;
        RetVAL: DINT;
        i_stAxisId := DRV_SercDrv.stLogicalAddress;
        IDN: DWORD := 16#13A68000; // UPID 13A6h (Maximal Current)
        IDNDataIN: DWORD ; // read data value
        NumBytetoRead: WORD:= 4; // read 4 bytes of data
        ReadDataLen: UINT; // actual length of read data
        MaxReadDataLen: UINT; // actual maximum length of read data (i.e. max possible length of a string)

END_VAR

...
// ReadIDN
IF StartReadIDN THEN

        RetVAL:=FC_SercosReadServiceData(
                i_stAxisId,
                IDN,
                5,
                ADR(IDNDataIN),
                NumBytetoRead,
                ReadDataLen,
                MaxReadDataLen);

                StartReadIDN := 0;

END_IF
…
```

10.6 PLC programming example

An example project for ELAU PLCs, including a library with basic functions for LinMot drives, is available.
Please contact our support departement for further information:

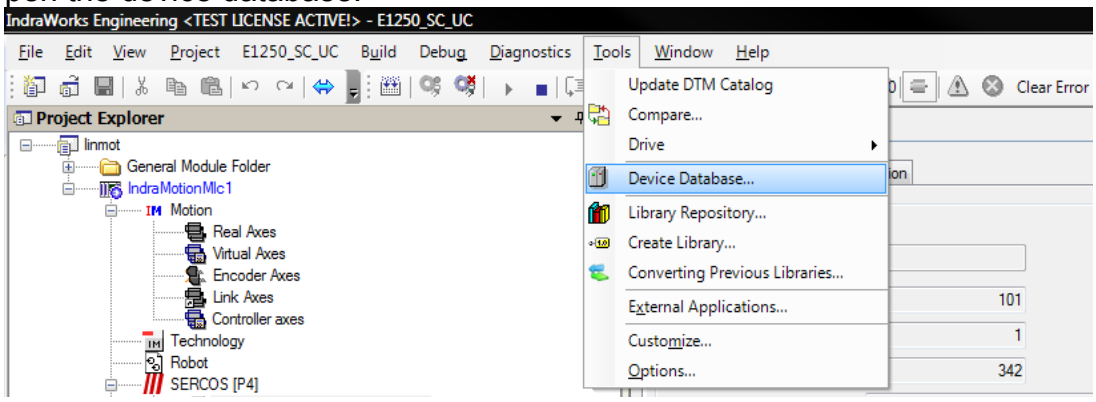
E-Mail: support@linmot.com
Phone: +41 (0)56 544 71 00
Skype: support.linmot

11. Commissioning with Bosch IndraLogic / IndraMotion PLCs

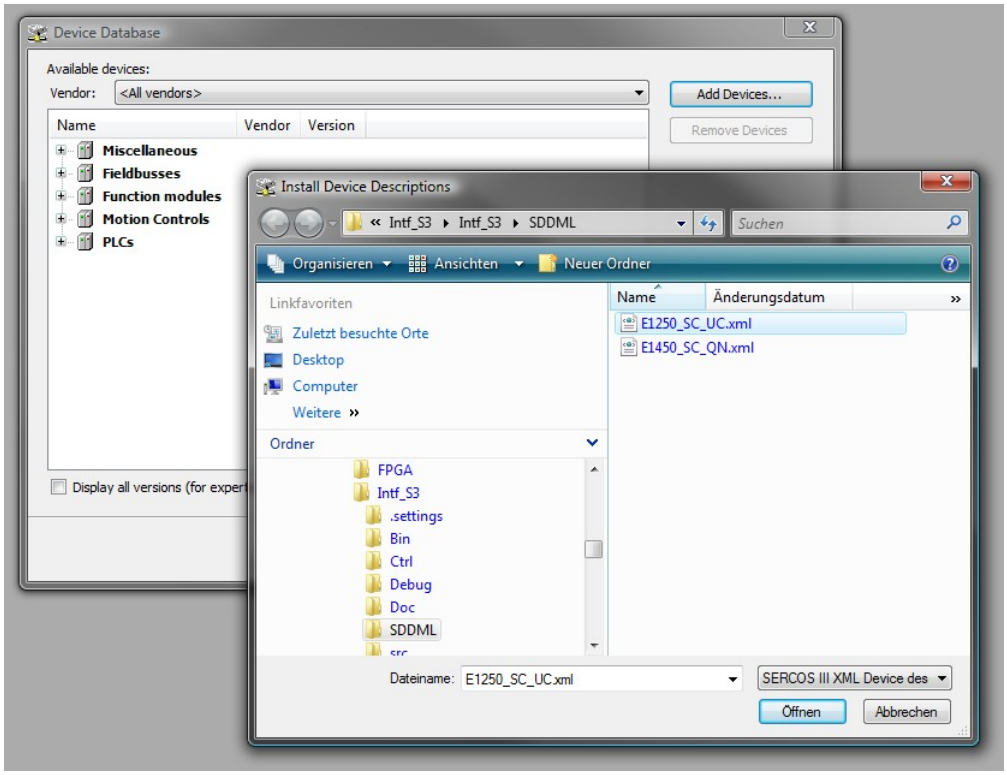
11.1 Integration as a sercos I/O device

11.1.1 Importing the SDDML-File

1. Open the device database:

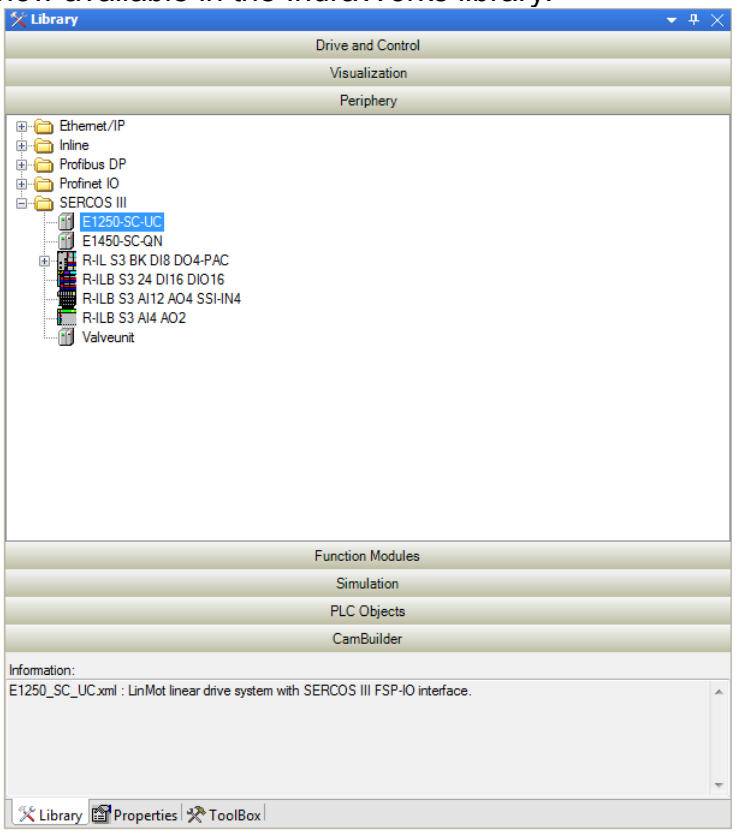


2. Add the LinMot device to the device database:



The SDDML-files are part of the LinMot-Talk installation. The default paths are:
"C:\Program Files\LinMot\LinMot-Talk x.x Build xxxxxxxx\Firmware\Interfaces\SERCOSIII\SDDML\",
"C:\Program Files\LinMot\LinMot-Talk x.x Build xxxxxxxx\Firmware\Interfaces\SERCOSIII_ML\SDDML\"

3. The device is now available in the IndraWorks library:



11.1.2 PLC programming example

An example project for Bosch-Rexroth PLCs, including a library with basic functions for LinMot drives, is available.
Please contact our support departement for further information:

E-Mail: support@linmot.com
Phone: +41 (0)56 544 71 00
Skype: support.linmot

11.2 Integration as a sercos drive

The LinMot E1250-SC-xx and E1450-SC-xx drives can also be integrated in an IndraLogic / IndraMotion system with the use of the SercosDrive object. This object uses the FSP_DRIVE profile and conforms to the sercos Pack Profile.
The drive is completely controlled using the the integrated functions and libraries from Bosch Rexroth which can be used with the SercosDrive object.
For further information on using this object, please consult the according manuals from Bosch Rexroth.

12. List of supported IDNs

12.1 sercos IDNs

IDN	Description	Validity (FSP_IO, FSP_Drive)
S-0-0011	Class 1 Diagnostic	Both
S-0-0012	Class 2 Diagnostic	Both
S-0-0014	Interface Status	Both
S-0-0015	Telegram type	FSP_Drive
S-0-0021	IDN-list of invalid operation data for CP2	Both
S-0-0022	IDN-list of invalid operation data for CP3	Both
S-0-0030	Manufacturer version	Both
S-0-0032	Primary operation mode	FSP_Drive
S-0-0047	Position command value	FSP_Drive
S-0-0051	Position feedback value 1	FSP_Drive
S-0-0055	Position polarity parameter	FSP_Drive
S-0-0076	Position data scaling type	FSP_Drive
S-0-0077	Linear position data scaling factor	FSP_Drive
S-0-0078	Linear position data scaling exponent	FSP_Drive
S-0-0079	Rotational position resolution	FSP_Drive
S-0-0084	Torque feedback value	FSP_Drive
S-0-0085	Torque polarity parameter	FSP_Drive
S-0-0095	Diagnostic message	Both
S-0-0099	Reset class 1 diagnostic	Both
S-0-0127	CP3 transition check	Both
S-0-0128	CP4 transition check	Both
S-0-0129	Manufacturer class 1 diagnostic	Both
S-0-0134	Drive control	FSP_Drive
S-0-0135	Drive status	FSP_Drive

IDN	Description	Validity (FSP_IO, FSP_Drive)
S-0-0147	Homing parameter	FSP_Drive
S-0-0148	Drive controlled homing procedure command	FSP_Drive
S-0-0181	Manufacturer class 2 diagnostic	Both
S-0-0390	Diagnostic number	Both
S-0-0398	IDN list of configurable real-time bits as producer	Both
S-0-0399	IDN list of configurable real-time bits as consumer	Both
S-0-0403	Position feedback value status	FSP_Drive
S-0-0420	Activate parameterization level procedure command	Both
S-0-0422	Exit parameterization level procedure command	Both
S-0-0423	IDN-list of invalid data for parameterization level	Both
S-0-0434	Serial number motor	Both
S-0-1000	SCP type & version	Both
S-0-1002	Communication cycle time (tScyc)	Both
S-0-1003	Allowed MST losses in CP3/CP4	Both
S-0-1009	Device control (C-Dev) offset in MDT	Both
S-0-1010	Lengths of MDTs	Both
S-0-1011	Device status (S-Dev) offset in AT	Both
S-0-1012	Lengths of ATs	Both
S-0-1013	SVC offset in MDT	Both
S-0-1014	SVC offset in AT	Both
S-0-1017	NRT transmission time	Both
S-0-1019	MAC address	Both
S-0-1026	Version of communication hardware	Both
S-0-1035	Error counter port1 and port2	Both
S-0-1040	sercos address	Both
S-0-1044	Device control (C-Dev)	Both
S-0-1045	Device status (S-Dev)	Both

IDN	Description	Validity (FSP_IO, FSP_Drive)
S-0-1046	List of sercos addresses in device	Both
S-0-1050.x.01	Connection setup	Both
S-0-1050.x.02	Connection number	Both
S-0-1050.x.03	Telegram assignment	Both
S-0-1050.x.04	Max. length of connection	Both
S-0-1050.x.05	Current length of connection	Both
S-0-1050.x.06	Configuration list	Both
S-0-1050.x.08	Connection control	Both
S-0-1050.x.10	Producer cycle time	Both
S-0-1050.x.11	Allowed data losses	Both
S-0-1050.x.20	IDN allocation of real-time bit	Both
S-0-1050.x.21	Bit allocation of real-time bit	Both
S-0-1051	Image of connection setups	Both
S-0-1300.0.1	Component name	Both
S-0-1300.0.2	Vendor name	Both
S-0-1300.0.3	Vendor code	Both
S-0-1300.0.4	Device name	Both
S-0-1300.0.5	Vendor device ID	Both
S-0-1300.0.7	Function revision	Both
S-0-1300.0.8	Hardware revision	Both
S-0-1300.0.9	Software revision	Both
S-0-1300.0.11	Order number	Both
S-0-1300.0.12	Serial number	Both
S-0-1300.0.13	Manufacturing date	Both
S-0-1300.0.20	Operational hours	Both
S-0-1301	List of GDP classes & version	Both

IDN	Description	Validity (FSP_IO, FSP_Drive)
S-0-1302.0.1	FSP type & version	Both
S-0-1302.0.3	Application Type	Both
S-0-1500.0.1	IO control	FSP_IO
S-0-1500.0.2	IO status	FSP_IO
S-0-1500.0.3	List of module type codes	FSP_IO
S-0-1500.0.32	IO Diagnostic message	FSP_IO

12.2 Manufacturer specific IDNs

IDN	Description	Validity (FSP_IO, FSP_Drive)
P-0-0100	LinMot StatusWord	Both
P-0-0101	LinMot StateVar	Both
P-0-0210	LinMot Config Module Control	Both
P-0-0211	LinMot Config Module Index In	Both
P-0-0212	LinMot Config Module Value In	Both
P-0-0220	LinMot Config Module Status	Both
P-0-0221	LinMot Config Module Index Out	Both
P-0-0222	LinMot Config Module Value Out	Both
P-0-1000	Used FSP Type (0:FSP Drive, 1:FSP I/O)	Both

13. RT LEDs

Error Codes		
RT Bus Error		OK

OK	RT Bus Error	Description
On	-	**Drive in CP 4**
Off	-	**Drive not in CP 4**
Flashing	-	**Drive in CP4 and in Loopback Mode:** Drive is at the end of a line and one of the ports is in loopback-mode.
-	On	**C1D Error:** One or more of the error bits in the C1D (S-0-0011) are set.
Flashing	Flashing	**Communication Warning** : Number of missed MST > S-0-1003.

14. Troubleshooting

14.1 Analyzing Traffic in sercos Networks

To analyze the data traffic in a sercos network, the use of a network protocol analyzer is strongly recommended.
Wireshark is one of the most used analyzers and can be downloaded free of charge from http://www.wireshark.org.

When using a network interface from a personal computer, make sure that any other protocols such as TCP/IP etc. are disabled for this interface. Transmission of any unwanted data frames from the personal computers operating system may lead to unpredictable behavior and/or errors in a connected sercos node.

14.2 Frequent Problems and Solutions

Problem	Possible Solution
Drive was not found by PLC	– Make sure that all the wiring is done correctly. Afterwards power down all devices including the PLC and start them up again.
Drive does not start up to CP4	– Make sure that all connected sercos devices have unique addresses when using this addressing mode. – Make sure that the topological addresses are configured correctly when using this addressing mode. – Make sure that the application type Strings (S-0-1302.0.3) are unique on all devices when using this addressing mode. – Make sure that the controller serial numbers are configured correctly on all devices when using this addressing mode. –

15. Contact Addresses

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Fax:	+41-(0)56-419 91 92
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LinMot, Inc.
5750 Townline Road
Elkhorn, WI 53121

Sales and Administration:	877-546-3270 262-743-2555
Tech. Support:	877-804-0718 262-743-1284
Fax:	800-463-8708 262-723-6688
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