LinMot®

DeviceNet™

Documentation of the DeviceNet Interface of the following Controllers:

- **E1100-DN, E1100-DN-HC**
- **E1100-GP, E1100-GP-HC**
- **E1100-DP, E1100-DP-HC**

DeviceNet Interface V3.6

User manual

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Document version 3.6 / June, 2006

1. System Overview

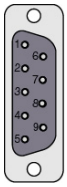
The LinMot DeviceNet controllers E1100-DN(-HC) and E1100-GP(-HC) supports the DeviceNet communication profile. Further information on DeviceNet can be found under: http://www.odva.org/

The LinMot DeviceNet controller is a UCMM Group 3 capable slave. And supports polled IO runtime data transmission.

2. Connecting the CAN bus

Pin Out of the COM Connector:

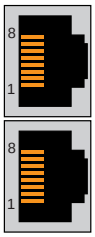
DSBU 9 male:



Pin 1	RS-485 Y	Pin 6	RS-485 B
Pin 2	RS-232 TX	Pin 7	RS-485 Z
Pin 3	RS-232 RX	**Pin 8**	**CAN L**
Pin 4	RS-485 A	**Pin 9**	**CAN H**
Pin 5	**GND**		

Pin Out of the CMD Connector:

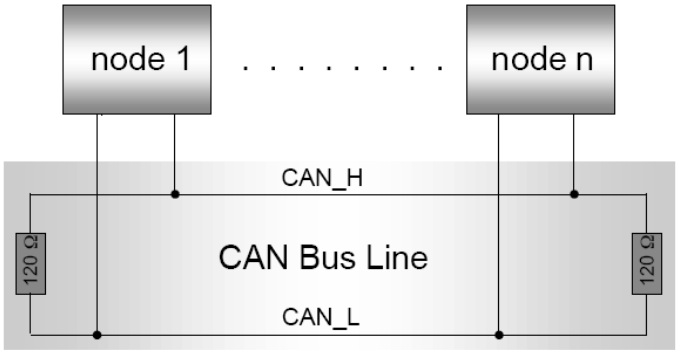
The CMD connector exists only at the E1100-DN(-HC) controllers, 2xRJ45 with 1:1 connected signals. Standard twisted pairs: 1/2, 3/6, 4/5, 7/8. Use Ethernet cables according the EIA / TIA 568A standard.



Pin 1	RS485 A
Pin 2	RS485 B
Pin 3	RS485 Y
Pin 4/5	**Ground**
Pin 6	RS485 Z
Pin 7	**CAN H**
Pin 8	**CAN L**

CAN Termination

The CAN bus must be terminated by two 120 Ohm resistors at both ends of the bus line, according the following scheme:



For easy installation, the LinMot DeviceNet controllers have built in termination resistors, which can be activated, if the LinMot controller is at the end of the bus line, and if there is no termination in the connector.

S3
On - Off

Interface	4
CAN Term	3
RS485 Term	2
RS485/232	1

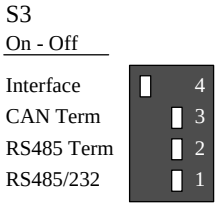
The built in termination resistor for the CAN bus can be activated by setting the dip switch “CAN Term” to “ON”.

3. Power Up Behaviour

The power up behaviour can be defined over the S3 switches and the S1 and S2 hex switches and the parameter configuration.

Activating and Deactivating the DeviceNet

Over the Interface Switch on the S3.4 switches the DeviceNet protocol can be activated (Switch On) or deactivated (Switch Off).



ID and Baud Rate Selection

With the default parameterization the baud rate is selected over S1 and the MACID is selected over S2.

Baud Rate Selection

The baud rate can be defined over the S1 hex switch (default setting) or by parameter value.

S1 Baud Rate Code Table	
S1 Value	**Selected Baud Rate**
0	Undefined Baud Rate (set to 125 kBaud)
1	**125 kBaud**
2	**250 kBaud**
3	**500 kBaud**
4	1000 kBaud (Invalid for DeviceNet
5	Undefined Baud Rate (set to 125 kBaud)
.	Undefined Baud Rate (set to 125 kBaud)
7	
.	Undefined Baud Rate

MACID Selection

Like the baud rate the MACID can be defined over the S2 hex switch (default setting), by parameter value or by the S1&S2 hex switches.

S2 ID code table	
S2 Value	**Selected MACID**
0	MACID = 0x00h
1	MACID = 0x01h
2	MACID = 0x02h
.	.
F	MACID = 0x0Fh

S1&S2 ID code table		
S1 Value	**S2 Value**	**Selected MACID**
0	0	MACID = 0x00h
1	1	MACID = 0x01h
2	2	MACID = 0x02h
.	.	.
1	0	MACID = 0x10h
.	.	
3	F	MACID = 0x3Fh
4	0	Invalid MACID
.	.	Invalid MACID
F	F	Invalid MACID

4. DeviceNet Parameters

The DeviceNet Servo Controllers have an additional parameter tree branch, which can be configured with the distributed LinMot-Talk1100 software. With these parameters, the DeviceNet behaviour can be configured. The software -Talk1100 can be downloaded from http://www.linmot.com under the section download, software & manuals.

Dis-/Enable With the Dis-/Enable parameter the LinMot servo controller can be run without the DeviceNet going online.

DeviceNet\ Dis-/Enable	
Disable	Servo controller runs without DeviceNet.
Enable	Servo controller runs only with a DeviceNet connection. (Default)

IMPORTANT: To activate the DeviceNet Interface, the Dip-Switch "Interface" at the bottom of the drive has to be set to "ON".

Baud Rate This directory contains the baud rate definition parameters.

Baud Rate Source Select

Defines the source of the baud rate definition.

DeviceNet\ Baud Rate\ Baud Rate Source Selection	
By Hex Switch S1	Look at S1 for baud rate selection. (1 = 125 kBit/s, 2=250 kBit/s, 3 = 500 kBit/s, 4 = 1 Mbit/s) (default)
By Parameter	Take the setting of the "Baud Rate Parameter Definition"

Baud Rate Parameter Definition

The Baud rate parameter defines the CAN bus baud rate for the DeviceNet connection.

DeviceNet\ Baud Rate Selection\ Baud Rate Parameter Def	
125 kBit/s [1]	CAN bus baud rate = 125 kBit/s
250 kBit/s [2]	CAN bus baud rate = 250 kBit/s
500 kBit/s [3]	CAN bus baud rate = 500 kBit/s (default)

MACID In this section the MACID (controller number) can be configured.

MACID Source Select

This parameter defines the source of the MACID.

DeviceNet\ MACID	
By Hex Switch S2	Look at S2 for ID definition (ID from 0 to 15) (default)
By Hex Switches S1 and S2	Look at S1 and S2 for ID definition (ID from 0 to 63 allowed).
By Parameter	Take the value from "MACID Parameter Value".

MACID Parameter Value

The ID, when “By Parameter” is selected as source.

Polled IO Config

These parameters define the mapping of the exchanged polled IO data. The configuration is split into the Command Configuration (the input to the Servo controller). And Response Configuration (the output of the servo controller).
The polled IO timeout value normally is configured from the master with the expected package rate, but is defaulted at startup.

DeviceNet\ Polled IO Config	
Command Config	Definition of the command data, exchanged through the polled IO telegrams. Master -> Slave
Response Config	Definition of the response data, exchanged through the polled IO telegrams. Slave -> Master
Polled IO Time Out	This parameter defines the polled data exchange timeout at startup.

Command Config

The command configuration determines the data that is sent from the PLC to LinMot Servo controller. The length of the default configured command data is 20 bytes.

DeviceNet \ Polled IO Config \ Command Configuration	
Control Word	Control Word is sent from PLC. (Default Selection On)
Motion Cmd Intf	Motion Command Interface, with 3 different length: • 3 Words • 6 Words • 9 Words (Default Selection On)
RAM Parameter Channel	RAM Parameter Channel (Default Selection Off) Memory Mapping of Parameter Channel: • 1. Word UPID • 2. Word Parameter Value Low Word • 3. Word Parameter Value High word

Response Config

The response configuration determines the data that is responded from the LinMot Servo controller to the PLC. The length of the default configured response data is 18 bytes. Each direct variable needs 4 bytes data space in the response telegram.

DeviceNet \ Polled IO Config \ Response Configuration	
Status Word	Status Word (Default Selection On)
State Var	State Variable (Default Selection On)
Error Code	Error Code (Default Selection Off)
Warn Word	Warn Word (Default Selection On)
Echo MC Intf Header	Send back MC interface header. (Default is Off)
Monitoring Channel 1	Monitoring Channel 1 Selection (Default On)
Channel 1 UPID	Monitoring Channel 1 UPID
Monitoring Channel 2	Monitoring Channel 2 Selection (Default On)
Channel 2 UPID	Monitoring Channel 2 UPID
Monitoring Channel 3	Monitoring Channel 3 Selection (Default On)
Channel 3 UPID	Monitoring Channel 3 UPID

Slave Config

The LinMot Servo controller offers a UCMM Grp 3 Service opened explicit message channel. And a Group 2 Master/Slave allocable explicit message channel.

DeviceNet\ Dis-/Slave Config	
Enable Grp 3 UCMM	Group 3 UCMM service is enabled
Force Group 2 Only Server	Group 3 UCMM service is disabled (Default)

IMPORTANT: Turn on the UCMM behaviour only if needed (second master to serve at the same time). Otherwise the Group 2 only server capabilities should be enough to serve the master at start up.

5. Memory Mapping Of The Default IO Configuration

Default Configured Command Data

Below the default configured receive data memory mapping is listed. The size of the consumed data is 10 words. One motion command parameter may use two words of the motion command parameter word.

Memory Mapping Default Configured Consumed Data		
Word Offset	Name	Description
0	Contrl Word	Bit mapped word to control the state machine of the servo
1	Motion command Header	Defines the command to execute, split into three parts: • Main ID (8 bit) • Sub ID (4 bit) • Execution count/toggle (4bit)
2	Motion Cmd 1. Par Word	1. Word Motion command Parameter
3	Motion Cmd 2. Par Word	2. Word Motion command Parameter
4	Motion Cmd 3. Par Word	3. Word Motion command Parameter
5	Motion Cmd 4. Par Word	4. Word Motion command Parameter
6	Motion Cmd 5. Par Word	5. Word Motion command Parameter
7	Motion Cmd 6. Par Word	6. Word Motion command Parameter
8	Motion Cmd 7. Par Word	7. Word Motion command Parameter
9	Motion Cmd 8. Par Word	8. Word Motion command Parameter

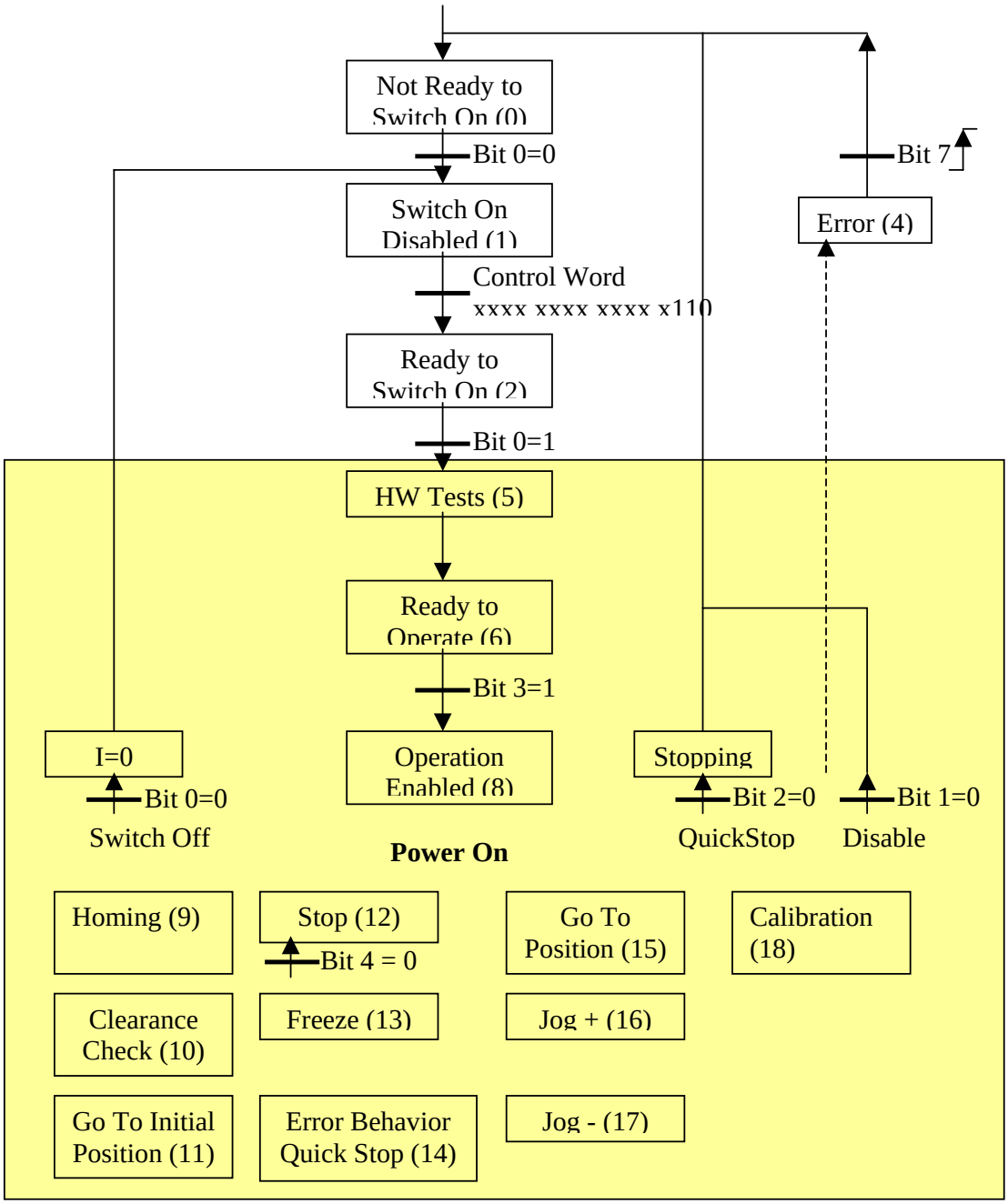
Default Configured Response Data

With the default configured response data the Servo can be supervised and monitored.

Memory Mapping Default Configured Produced Data		
Word Offset	Name	Description
0	Status Word	Bit mapped word, to monitor some important events/states.
1	State Var	Mirror of the main state machine, split into high and low byte: • Main State ID (high byte) • Sub State ID (low byte)
2	Warn Word	Bit mapped word, to monitor the warnings.
3	Monitoring Channel 1 Data Low Word	
4	Monitoring Channel 1 Data High Word	
5	Monitoring Channel 2 Data Low Word	
6	Monitoring Channel 2 Data High Word	
7	Monitoring Channel 3 Data Low Word	
8	Monitoring Channel 3 Data High Word	

6. State Machine

The main behavior of the axles is controlled with the control word, it's shown in the following state diagram.



7. Control Word

With the Control Word (16Bit) the main state machine of the servo controller can be accessed. Following table shows the meaning of each bit:

Bit Name	Val	Meaning	Remark
0 Switch On	0	OFF1	A-Stop, -> Current = 0, power switches disabled
	1	ON	State change from switch on disabled to ready to switch on
1 Safety Voltage Enable	0	OFF2	Power switches disabled without microcontroller action
	1	Operation	
2 Quick Stop	0	OFF3	Quick Stop -> Current = 0 -> H-Bridges disabled
	1	Operation	
3 Enable Operation	0	Operation disabled	I = 0 (H-Bridges enabled)
	1	Operation enable	Position controller active
4 Abort	0	Stop	Quick Stop position control rests active, motion command is cleared.
	1	Operation	
5 Freeze	0	Freeze motion	Quick Stop position control rests active, Target position not cleared, curves motions are aborted
	1	Operation	Rising edge will reactivate motion command
6 GoTo Position		Go To Position	Go to fixed parameterized Position. Wait for release of signal.
7 Acknowledge	0		
	1	Error Acknowledge	Rising edge of signal acknowledges error
8 Jog Move +	0		
	1		Jog Move +
9 Jog Move -	0		
	1		Jog Move -
10 Reserved Pos Ctrl Auto tuning	0		
	1		Reserved Controller Auto tuning
11 Homing	0	Stop Homing	Quick Stop position control rests active
	1	Start Homing	At startup bit 11 Status word is cleared, until procedure is finished.
12 Clearance Check	0	Stop Clearance Check	
	1	Clearance Check	Enable Clearance Check Movements
13 Go To Initial Pos	0		
	1	Go To initial Pos	Rising edge will start go to initial position
14 Reserved Calibration	0	Stop Calibration	
	1	Calibration	Reserved Enable Calibration Movements
15 Reserved Phase Search	0	Stop Phase Search	
	1	Phase Search	Reserved Enable Phase Search Movements

8. Status Word

Following table shows detailed meaning of the single bits:

Bit Name	Val	Meaning	Description
0 Busy	0	Not Ready to Operate	Initialization of axis not completed yet
	1	Ready to Operate	H-Bridges enabled, I = 0
1 Ready	0	Switch On Disabled	
	1	Switch On Enabled	Control Word Bit 0
2 Enabled	0	Operation Disabled	
	1	Operation Enabled	Control Word Bit 3
3 Error	0	No Error	
	1	Error	Acknowledge with Control word Bit 7 (Reset Error) rising edge → State: Not Ready to Switch On
4 Safety Voltage Enable	0	OFF2 Power Bridge Off	Safety Voltage Enable signal is low active
	1	Operation	Control Word Bit 1
5 OFF3 active	0	OFF3 active	Quick Stop OFF3 signal is low active
	1	Operation	
6 Locked	0	Not Locked	
	1	Locked	Release with 0 of Control word bit 0 (Switch On)
7 Warning	0	Warning not active	
	1	Warning active	Motion commands still possible, disables state transition form Switch On Disabled → Ready to Switch On
8 Trigger Intf Active	0		
	1	Trig Intf Active	
9 Special Motion Cmd active	0	Normal Operation	
	1	Special Command runs	Special motion commands (Homing, Clearance check, calibration, ..) is running
10 in Position	0	Not In Pos	Motion active or actual position out of window
	1	In Pos	Actual position after motion in window
11 Homed	0	Motor not referenced	
	1	Motor referenced	
12 Command In Buffer	0	Command buffer empty	
	1	Command in buffer	
13 Motion active	0	Motor not moving	No Motion active
	1	Motor moves	Motion active
14 Position Band 1	0	Not In Position Band 1	Actual Position Not In Position Band 1
	1	In Position Band1	Actual Position Is In Position Band 1
15 Position Band 2	0	Not In Position Band 1	Actual Position Not In Position Band 2
	1	In Position Band2	Actual Position Is In Position Band 2

9. Examples

With the following examples the first steps in programming should be explained.

Reset Control Word

Memory Mapping Default Configured Consumed Data			
Word Offset	Name	Value	Description
0	Contrl Word	0000h	Reset all bits in Ctrl Word
1	Motion Cmd Header	0000h	No Motion Cmd
2	Motion Cmd 1. Par Word	0000h	Not used
3	Motion Cmd 2. Par Word	0000h	Not used
4	Motion Cmd 3. Par Word	0000h	Not used
5	Motion Cmd 4. Par Word	0000h	Not used
6	Motion Cmd 5. Par Word	0000h	Not used
7	Motion Cmd 6. Par Word	0000h	Not used
8	Motion Cmd 7. Par Word	0000h	Not used
9	Motion Cmd 8. Par Word	0000h	Not used

After these command the high byte of the state variable changes to 2.

Set Control Word Switch On

Memory Mapping Default Configured Consumed Data			
Word Offset	Name	Value	Description
0	Contrl Word	003Fh	Set bits 0..5 in Ctrl Word
1	Motion Cmd Header	0000h	No Motion Cmd
2	Motion Cmd 1. Par Word	0000h	Not used
3	Motion Cmd 2. Par Word	0000h	Not used
4	Motion Cmd 3. Par Word	0000h	Not used
5	Motion Cmd 4. Par Word	0000h	Not used
6	Motion Cmd 5. Par Word	0000h	Not used
7	Motion Cmd 6. Par Word	0000h	Not used
8	Motion Cmd 7. Par Word	0000h	Not used
9	Motion Cmd 8. Par Word	0000h	Not used

After these command the high byte of the state variable changes to 8.

Set Control Word Home Request

Memory Mapping Default Configured Consumed Data			
Word Offset	Name	Value	Description
0	Contrl Word	083Fh	Set bits 0..5 and 11 in Ctrl Word
1	Motion Cmd Header	0000h	No Motion Cmd
2	Motion Cmd 1. Par Word	0000h	Not used
3	Motion Cmd 2. Par Word	0000h	Not used
4	Motion Cmd 3. Par Word	0000h	Not used
5	Motion Cmd 4. Par Word	0000h	Not used
6	Motion Cmd 5. Par Word	0000h	Not used
7	Motion Cmd 6. Par Word	0000h	Not used
8	Motion Cmd 7. Par Word	0000h	Not used
9	Motion Cmd 8. Par Word	0000h	Not used

After these command the high byte of the state variable changes to 9. Wait until bit 11 in the status word occurs, then release bit 11 in the control word again.

Reset Control Word Home Request

Memory Mapping Default Configured Consumed Data			
Word Offset	Name	Value	Description
0	Contrl Word	003Fh	Set bits 0..5 and reset bit 11 in Ctrl Word
1	Motion Cmd Header	0000h	No Motion Cmd
2	Motion Cmd 1. Par Word	0000h	Not used
3	Motion Cmd 2. Par Word	0000h	Not used
4	Motion Cmd 3. Par Word	0000h	Not used
5	Motion Cmd 4. Par Word	0000h	Not used
6	Motion Cmd 5. Par Word	0000h	Not used
7	Motion Cmd 6. Par Word	0000h	Not used
8	Motion Cmd 7. Par Word	0000h	Not used
9	Motion Cmd 8. Par Word	0000h	Not used

After these command the high byte of the state variable changes to 8. Now the servo controller is ready for motion commands.

Motion Command Go To Absolute Position 50mm

Memory Mapping Default Configured Consumed Data			
Word Offset	Name	Value	Description
0	Contrl Word	003Fh	Set bits 0..5 in Ctrl Word
1	Motion Cmd Header	0101h	VAI Go To Pos, Cmd Count = 1
2	Motion Cmd 1. Par Word	A120h	Target position (50mm) low word
3	Motion Cmd 2. Par Word	0007h	Target position (50mm) high word
4	Motion Cmd 3. Par Word	4240h	Maximal Velocity (1m/s) low word
5	Motion Cmd 4. Par Word	000Fh	Maximal Velocity (1m/s) high word
6	Motion Cmd 5. Par Word	4240h	Acceleration (10m/s^2) low word
7	Motion Cmd 6. Par Word	000Fh	Acceleration (10m/s^2) high word
8	Motion Cmd 7. Par Word	4240h	Deceleration (10m/s^2) low word
9	Motion Cmd 8. Par Word	000Fh	Deceleration (10m/s^2) high word

After these command the motor moves to the defined target position with the defined Maximal Velocity, Acceleration and Deceleration.

Motion Command Go To Absolute Position 0mm

Memory Mapping Default Configured Consumed Data			
Word Offset	Name	Value	Description
0	Contrl Word	003Fh	Set bits 0..5 in Ctrl Word
1	Motion Cmd Header	0102h	VAI Go To Pos, Cmd Count = 2
2	Motion Cmd 1. Par Word	0000h	Target position (0mm) low word
3	Motion Cmd 2. Par Word	0000h	Target position (0mm) high word
4	Motion Cmd 3. Par Word	4240h	Maximal Velocity (1m/s) low word
5	Motion Cmd 4. Par Word	000Fh	Maximal Velocity (1m/s) high word
6	Motion Cmd 5. Par Word	4240h	Acceleration (10m/s^2) low word
7	Motion Cmd 6. Par Word	000Fh	Acceleration (10m/s^2) high word
8	Motion Cmd 7. Par Word	4240h	Deceleration (10m/s^2) low word
9	Motion Cmd 8. Par Word	000Fh	Deceleration (10m/s^2) high word

After these command the motor moves to the new defined target position with the defined Maximal Velocity, Acceleration and Deceleration.