Practical Applications

Serie E1100 & B1100 Controller

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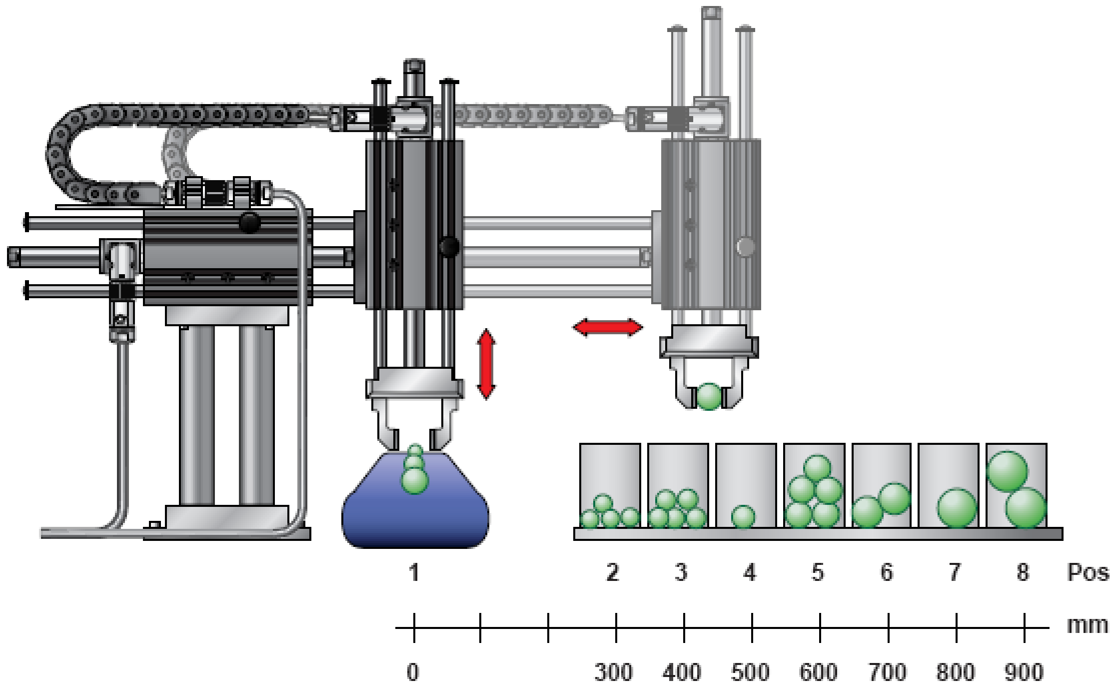

Note
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Use Of This Document

This document is an introduction to the different functionality of the LinMot E1100 and B1100 series controllers which are shown in several practical applications.

Controller: E1100 & B1100

Classification: Training

Recommended Documentation

The user manuals are included in LinMot-Talk1100 or can be downloaded on www.linmot.com in the category „Download -> Software & Manuals -> E1100/B1100 Controllers“.

The most important and recommended documents regarding the examples in this documents are shown below:

- LinMot-Talk1100
- Motion Control Software
- Installation guide E1100 servo controllers
- Installation guide B1100 servo controllers
- Master Slave Application
- EasySteps Application
- TF Force Control
- EC-Motors with E1100/B1100

Introduction

a. Parametrization Using LinMot-Talk1100

Motor Configuration Using The Motor Wizard

When a new controller is started up for the first time, the connected motor needs to be configured. LinMot Talk1100 provides a Motor Wizard for this task, which guides the user, step by step, through the basic settings of the motor.

Figure 1: The Motor Wizard is started with the magic wand symbol

Configuration Of Application Parameters

All LinMot firmware parameters can be adapted to the requirements of the application using LinMot Talk1100 software. A unique identification number is assigned to each parameter. This number, called the UPID (Unique Parameter ID), is a 16-bit number. It is shown in hexadecimal format.

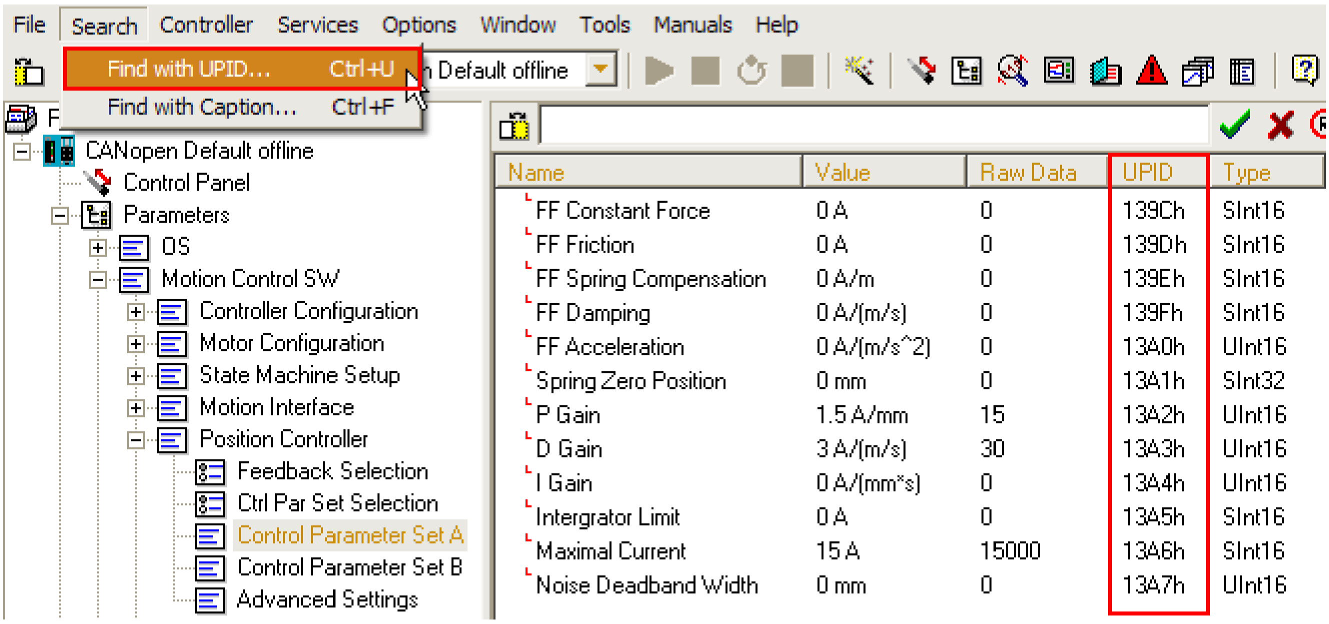


Figure 2: UPID Display in LinMot-Talk1100

Note

In the following applications the path to the required paramters is shown. If this path is to long to be displayed it is shorten.

E.g. *\Parameters**Motion Control SW**\Motion Interface\RunMode Settings\Run Mode Selection*
becomes *\Parameters**MC SW**\Motion Interface\RunMode Settings\Run Mode Selection*

Using the “Find UPID” search function (menu bar “Search -> Find with UPID” or the keystroke combination “Ctrl + U”, a parameter can be found by its UPID number. The UPID is displayed in the “UPID” column for each parameter (see illustration).

b. Control And Status Word

Figure 3 shows the signal sequence for powering up and referencing (homing) the motor, both in normal operation and after acknowledging a fault. It also shows the most important signals (state of the relevant bits in the Control and Status Word) for controlling the state machine.

The state machine is described in chapter 3 of the “Motion Control SW” manual.

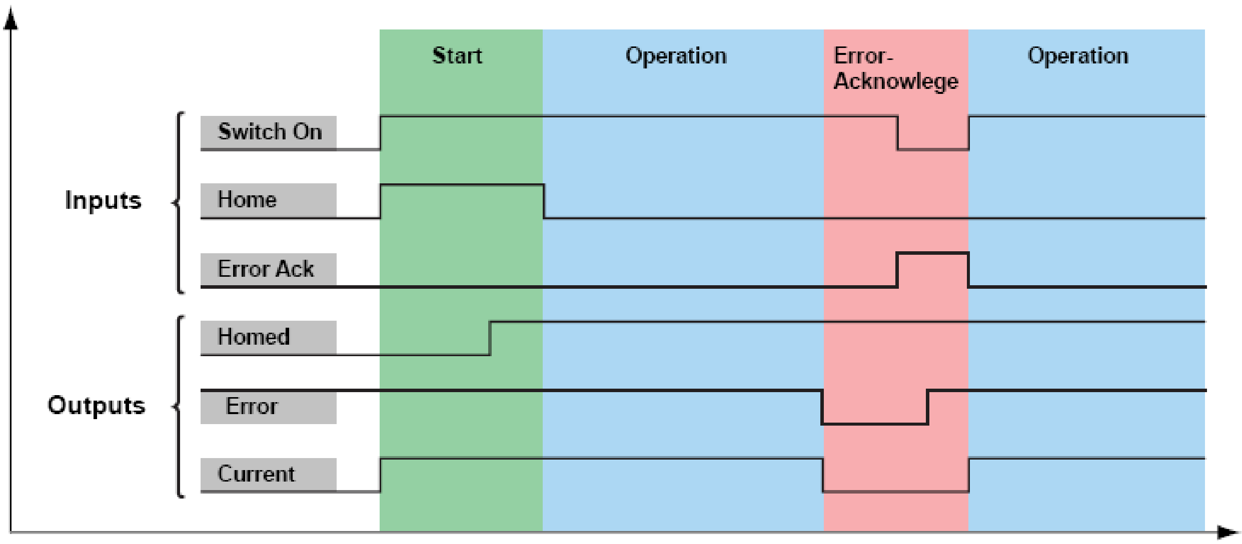


Figure 3: Signals for controlling the state machine

c. Controlling The State Machine Using Digital Inputs And Outputs On X4 (E1100) / X14 (B1100)

Control signals for the state machine can be configured on connector X4 respectively X14, in order to control the state machine using digital signals. All signals can be assigned to X4 respectively X14 as desired. An example of a configuration is below.

Inputs			\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions	
Function	**Value**	**E1100 (UPID)**	**B1100 (UPID)**	**Description**
Ctrl Word: Switch On (Input)	On	1036h	62E8h	Switch On on X4.3 / X14.14
Ctrl Word: Home (Input)	On	1037h	62E9h	Home onX4.4 / X14.2
Ctrl Word: Error Acknowledge (Input)	On	1038h	62EAh	Error Ack on X4.5 / X14.15

Table 1: Configuration of the digital inputs on X4 (E1100) / X14 (B1100)

Outputs			\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions	
Function	**Value**	**E1100 (UPID)**	**B1100 (UPID)**	**Description**
Status Word: Homed (Output)	On	1039h	62EEh	Homed on X4.6 / X14.17
Status Word: Error (Output)	On	103Ah	62EFh	Error on X4.7 / X14.5

Table 2: Configuration of the digital outputs on X4 (E1100) / X14 (B1100)

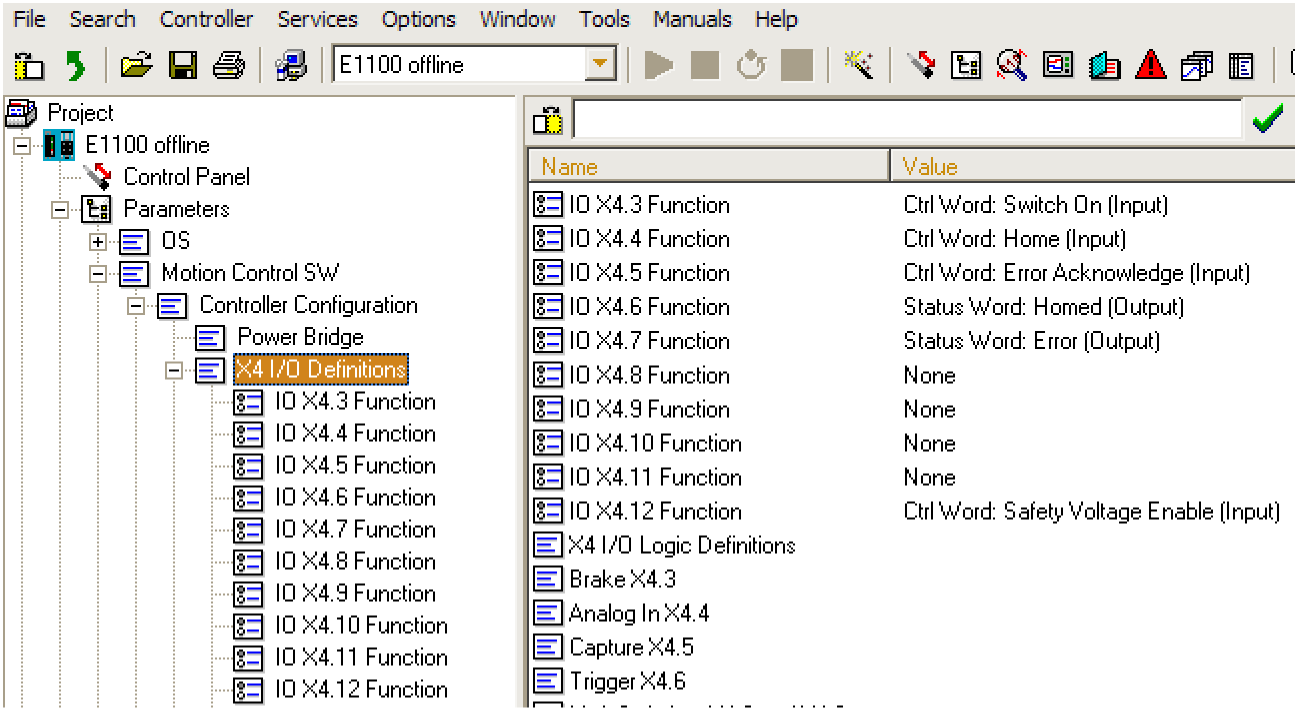


Figure 4: X4 I/O Definitions, control signals configured on connector X4 (E1100)

Note

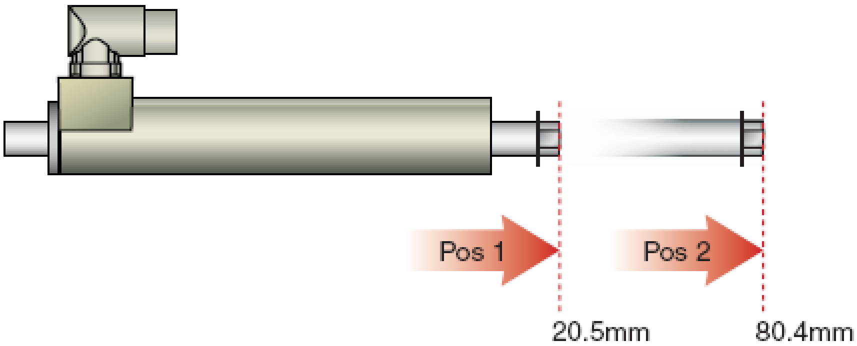
Safety Voltage Enable (SVE)
E1100 series controllers (except for E1100-GP) have the Safety Voltage Enable input on X4.12. In order to run, +24V DC must be connected here. Otherwise, the PWM generator in the power electronics is hardware-disabled.

Invert the I/O Logic
The logic (active high / active low) of the digital inputs and outputs is configured under "X4 I/O Definitions (E1100: UPID 104Bh to 1053h) respectively „X14 I/O Logic Definitions“ (B1100: UPID 43B0h to 43B5h and 43B8h to 43BDh).

The error output can be configured such that it is high (+24V) during operation, and low (0V) in the error state.

1. Pusher With Two End Positions

E1100 AND B1100



Application

A product must be moved from point A (Pos 1, 20.5mm) to point B (Pos 2, 80.4mm). Selection of the two positions is made via a digital signal. When the motor reaches one of the two positions, this should be indicated to the controllers via a digital output.

Solution

LinMot provides the Run Mode "Triggered VA Interpolator" for this application. In this mode, the motor can move to two positions on the rising or falling edge of a digital trigger signal. Both velocity and acceleration can be programmed as desired (VA Interpolator). The VA Interpolator calculates a trapezoidal velocity profile for the stroke time.

The motor moves to Position 1 on the falling edge, and Position 2 on the rising edge of the trigger signal on X4.6 / X14.15. If the drive is in one of the two positions, this is indicated on X4.5 / X14.17 (configure as digital output).

Configuration

Hardware Interface
The trigger signal is wired to X4.6 (E1100) / X14.15 (B1100)

Function	**Value**	**E1100 (UPID)**	**B1100 (UPID)**	**Description**
Configure RunMode	\Parameters\Motion Control SW\Motion Interface\RunMode Settings\Run Mode Selection			
Triggered VA-Interpolator	On	1450h	62A8h	Run Mode Triggered VAI
Trigger input *	\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions			
Trigger (Input)	On	1039h	62EAh	Trigger on X4.6 / X14.15
Direct	On	170Ch	62D8h	Trigger Mode „Direct"

* The trigger mode (Direct, inhibited and/or delayed) and the according parameters can be found here:
\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions\Trigger

Output				\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions
Status Word: In Target Position	On	1038h	62EEh	In Pos an X4.5 / X14.17

Position 1				\Parameters\MC SW\Motion Interface\Run Mode Settings\Triggered VA-Interpolator\Trig Fall Config
Position	20.5mm	145Ah	F14Dh	Position 1
Max. Speed	0.2m/s	145Bh	F14Ch	Maximum velocity
Acceleration	$3m/s^2$	145Ch	F14Ah	Acceleration
Deceleration	$3m/s^2$	145Dh	F14Bh	Deceleration

Position 2				\Parameters\MC SW\Motion Interface\Run Mode Settings\Triggered VA-Interpolator\Trig Rise Config
Position	80.4mm	145Fh	F151h	Position 2
Max. Speed	0.4m/s	1460h	F150h	Maximum velocity
Acceleration	$5m/s^2$	1461h	F14Eh	Acceleration
Deceleration	$5m/s^2$	1462h	F14Fh	Deceleration

Oszilloscope

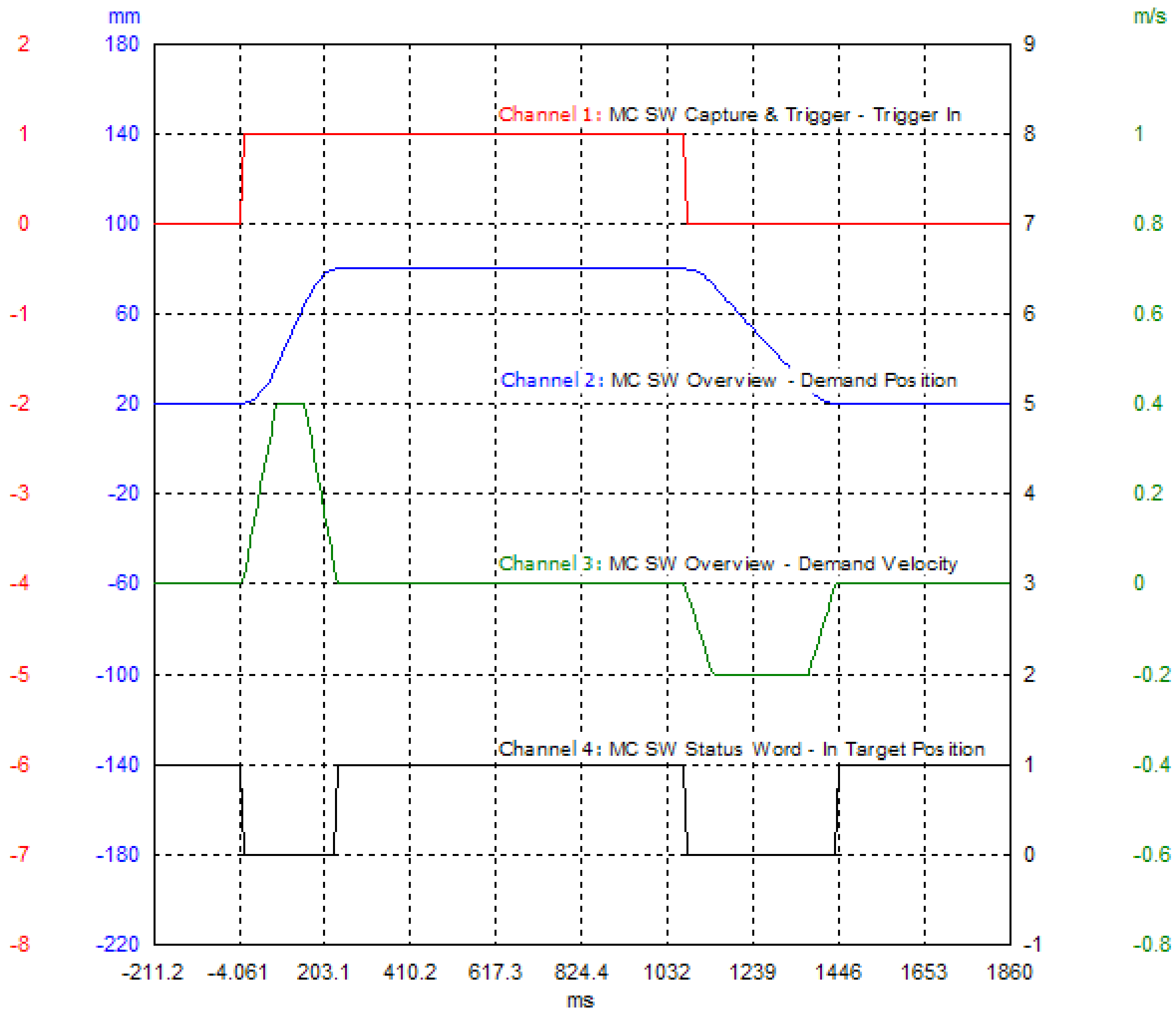
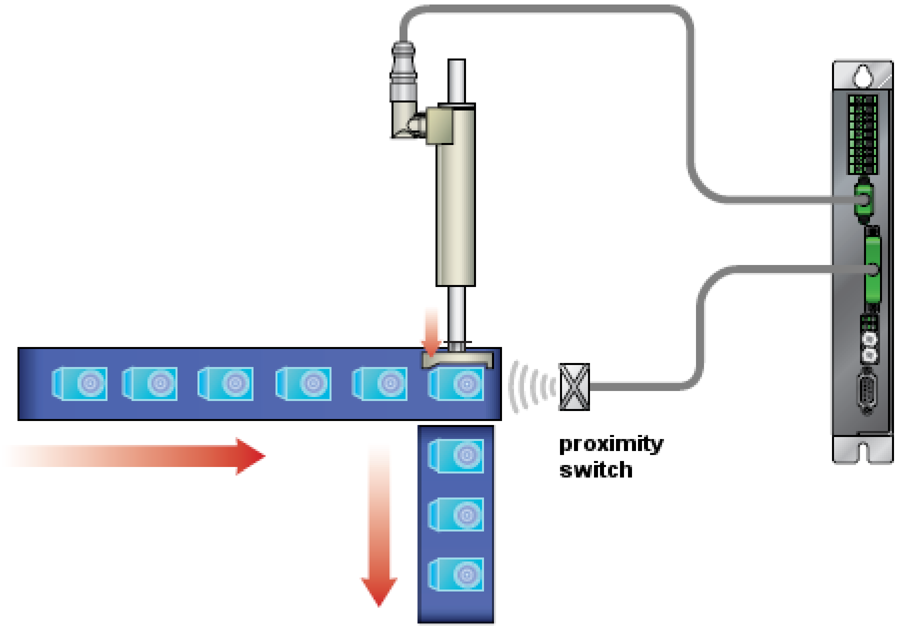


Figure 5: Oscilloscope of one cycle

2. Positioning Using Motion Profiles

E1100 AND B1100 *



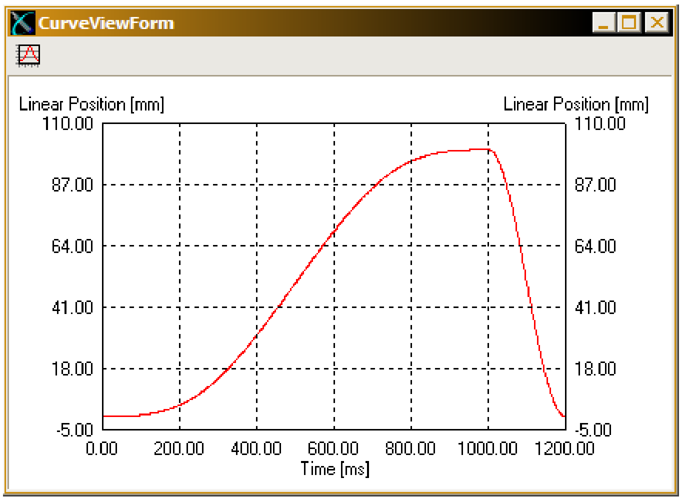
Application

Contact lenses are packaged in a machine. In order to avoid spilling the liquid, it must be moved without jerking (minimal jerk). The packaging must be positioned at its target point (100mm) without jerk, while the return to the starting position (0mm) of the linear drive must be as fast as possible. The motion is initiated by a trigger signal from a proximity switch.

Solution

The "Triggered Time Curve" Run Mode is provided for this application. The rising edge of the trigger input invokes a motion profile that is stored in the controller. The motion profile can be executed after a delay following the trigger signal (delayed). This makes it easier to coordinate the actuation of the proximity switch and the start of the motion.

The desired motion profile is generated using the curve service (LinMot-Talk1100 manual). Select 1 as the ID of the generated curve, and download it to the controller.



Configuration

Hardware Interface
The trigger signal is wired to X4.6 (E1100) / X14.15 (B1100)

Function	Value	E1100 (UPID)	B1100 (UPID)	Description
Configure RunMode	\Parameters\Motion Control SW\Motion Interface\RunMode Settings\Run Mode Selection			
Triggered Time Curves	On	1450h	62A8h*	Run Mode Triggered T. Curves
Trigger input	\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions			
Trigger (Input)	On	1039h	62EAh	Trigger on X4.6 / X14.15
Delayed	On	170Ch	62D8h	Trigger Mode „Delayed“
Rise Delay Time	50ms	170Fh	62DBh	Set delay time
Set motion profile	\Parameters\MC SW\Motion Interface\Run Mode Settings\Triggered Curves Settings			
Rise Curve ID	1	1482h	62A4h*	Set ID of the curve

Note B1100 Controller

* The curve support on B1100-GP controllers has to be unlocked with an access key.
The key has to be ordered separately. Minimal software requirement is LinMotTalk1100 V3.11.

Note

The LinMot-Talk1100 software supports the import of CSV files (Excel). Motion profiles generated in Excel can thus be imported to the controller (Figure 6).

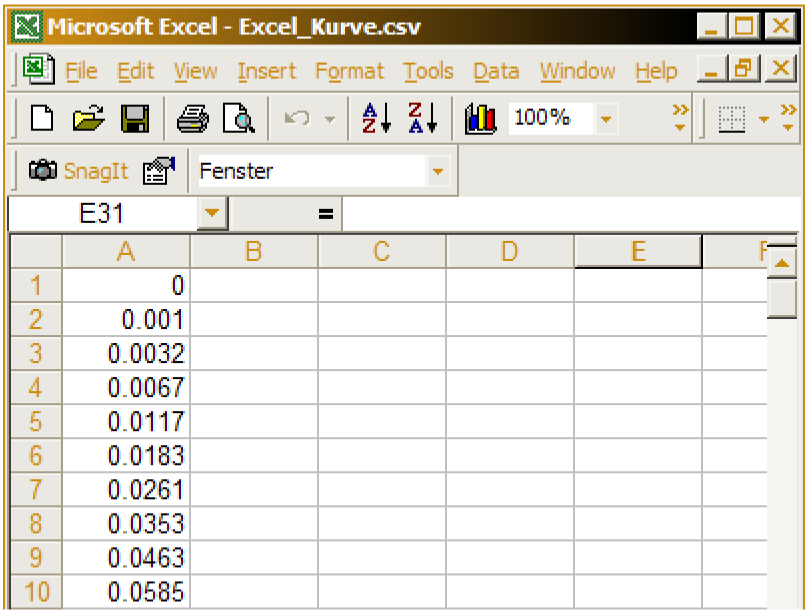
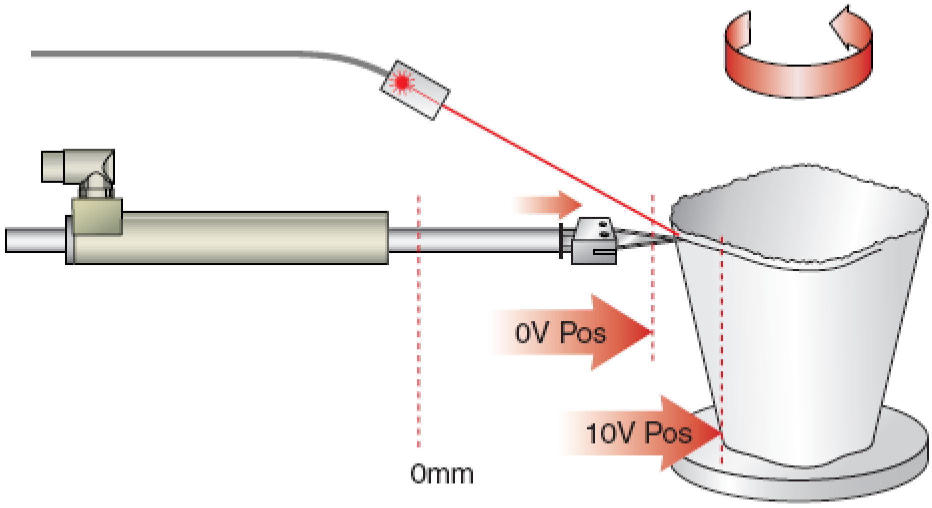


Figure 6: The base values of a motion profile are listed in mm in Column A. The CSV file can be imported in the Curve Service in LinMot Talk1100. When generating a new curve, select “FromFile” in the “Setpoint Calculation Wizard.”

3. Analog Position Mode

E1100 AND B1100



Application

A blade guided by a linear drive has to cut open bottles with irregular shapes. The blade is to track to the shape of the bottle.

A distance sensor measures the distance to the surface of the bottle, and sends the target position to the linear drive via an analog signal from 0V (meaning 20mm) to 10V (meaning 80mm). Using a second, digital signal, the drive must be able to move to a waiting position (0mm).

Solution

Positioning using an analog input signal is supported by the “Analog” Run Mode. The linear motor is positioned between two freely configurable 0V and 10V positions, “proportional” to the input voltage on X4.4 (E1100) / X14.20 (B1100).

The “Going To Position” function moves the drive to a waiting position. A digital signal is connected to X4.3 (E1100) / X14.14 (B1100) for this purpose. If the controller recognizes a high signal on this input, it changes to State 15: Going To Position, and moves the drive to the configured position. If a low signal is present at this input, the controller is in State 8: Operation Enabled, and follows the analog input signal.

Configuration

Hardware Interface
The analog signal is connected to X4.4 (E1100) / X14.20 (B1100)
The digital signal is connected to X4.3 (E1100) / X14.14 (B1100)

Function	Value	E1100 (UPID)	B1100 (UPID)	Description
Configure RunMode	\Parameters\Motion Control SW\Motion Interface\RunMode Settings\Run Mode Selection			
Analog	On	1450h	62A8h	Run Mode Analog

Analog Input	\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions			
Analog	On	1037h	* -	X4.4 as analog input
Position	On	1790h	62B2h	Signal type „Position“
0V Position	20mm	14D2h	F156h	0V Position
10V Position	80mm	14D3h	F157h	10V Position

* Not needed as the B1100 controller has a fix analog input on X14.20

Digital Input	\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions			
Ctrl Word: Go To Position	On	1036h	62E8h	X4.3 / X14.14

Predef VA-Interpolator (Dynamics Analog Mode)	\Parameters\Motion Control SW\Motion Interface\Predef VA Interpolator			
Max. Speed	1m/s	14BEh	F0C4h	Maximum velocity
Acceleration	4m/s²	14BFh	F0C5h	Acceleration
Deceleration	4m/s²	14C0h	F0C6h	Deceleration

Position and Dynamics of Wait Position (Go To Position)	\Parameters\Motion Control SW\State Machine Setup\Go To Position			
Position	0mm	1725h	F146h	Wait position
Max. Speed	0.1m/s	1726h	F147h	Maximum velocity
Acceleration	1m/s²	1727h	F148h	Acceleration
Deceleration	1m/s²	1728h	F149h	Deceleration

Note

If the signal at X4.3 / X14.14 is high (24V), the linear motor moves to the 0mm position (waiting position). If no voltage is present at X4.3 / X14.14, the drive follows the analog signal at X4.4.The settings for the predefined VA Interpolator are used for analog positioning.

An overview and description of the various states can be found in the “Motion Control SW” manual.

4. Indexing Mode (Step/Direction/Zero)

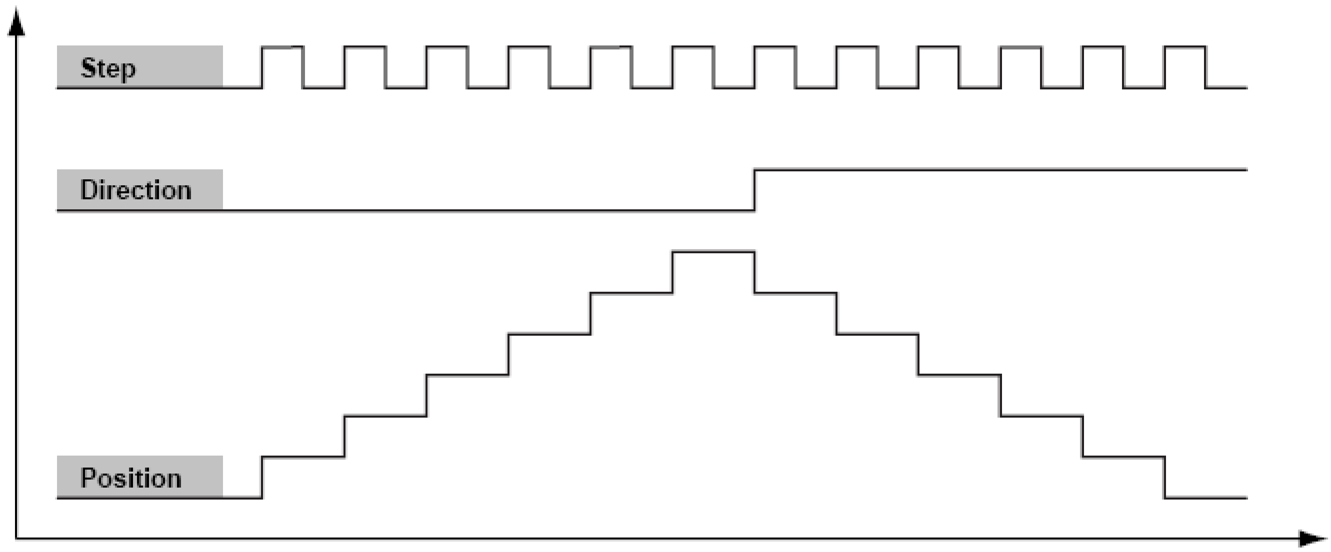
E1100 AND B1100

Application

Stepper motors with an overarching stepper motor controller (Step/Direction/Zero) have been used up to now in an existing application. They are now going to be replaced with linear motors, due to higher requirements for dynamics and process reliability. The step distance is 0.1µm/step.

Solution

The “Position Indexing” Run Mode is provided for this application. In this mode, the motor follows the counter value of the indexer input. The indexer signal can be STEP/DIRECTION/ZERO (SDZ) or an incremental signal (ABZ).



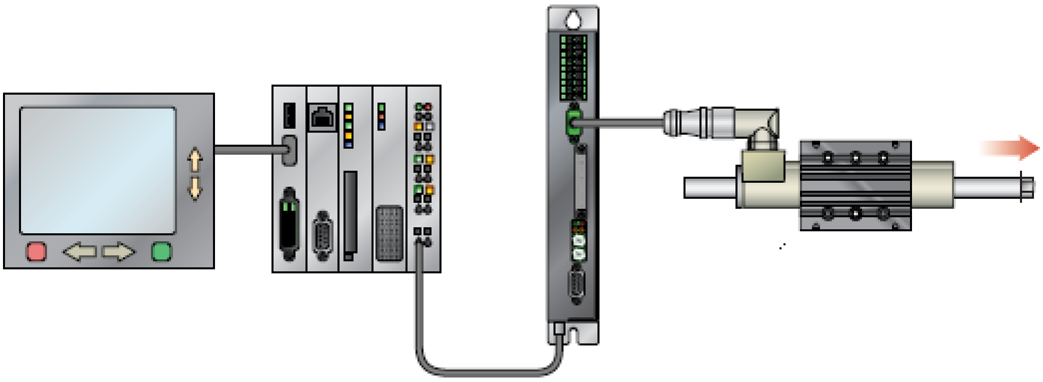
Configuration

Hardware Interface
Connect the indexing signal to X12 (E1100) / X14 (B1100)

Function	Value	E1100 (UPID)	B1100 (UPID)	Description
Configure RunMode	\Parameters\Motion Control SW\Motion Interface\RunMode Settings\Run Mode Selection			
Position Indexing	On	1450h	62A8h	Run Mode Position Indexing
Define Encoder Source (B1100)	\Parameters\Motion Control SW\Controller Configuration\Indexing Encoder			
Diff Encoder Input X14	On	-	62D6h	Indexing-signals connection
Step Dir (SD)	On	-	62CFh	Encoder type
1x	On	-	62D7	1x Decoding
Define Encoder Source (E1100)	\Parameters\Motion Control SW\Controller Configuration\Master Encoder			
Ext Sensor Input X12	On	17A2h	-	Indexing-signals connection
Step Dir Zero (SDZ)	On	128Eh	-	Encoder type
1x	On	128Fh	-	1x Decoding
Position Step per Indexer Increment	\Parameters\MC SW\Motion Interface\RunMode Settings\Pos Indexing Settings			
Resolution	0.1um	14DDh	715Ch	Step distance
Limit Dynamics	\Parameters\Motion Control SW\Motion Interface\Predef VA Interpolator			
Max. Speed	1m/s	14BEh	F0C4h	Maximum velocity
Acceleration	5m/s^2	14BFh	F0C5h	Acceleration
Deceleration	5m/s^2	14C0h	F0C6h	Deceleration

5. Moving To Any Desired End Positions, Using Serial Interfaces Or Fieldbusses

E1100 AND B1100



Application

The end positions of the linear drive must be freely programmable by the operator at the panel. In this example, he wants to move from the starting position (0mm) to 20mm (v=1m/s, a=10m/s^2), then to 80mm (0.2m/s, 1m/s^2), then back to 0mm (2.5m/s, 30m/s^2). The panel is connected to a PLC, which communicates with the LinMot controller via a serial interface or fieldbus.

Solution

LinMot controllers can be connected to a superior control system via various interfaces, such as Ethernet, Profibus DP, CANOpen, DeviceNet, LinRS Protocol (RS232 and RS485). The desired end positions can be set directly by the controller.

The following resources are needed for communication with the controller.

Control Word: The state machine in the controller is controlled by the Control Word (Table 3). Among other things, the controller is started and initialized using the Control Word, errors are acknowledged, a QuickStop is initiated, etc.

Status Word: Information about the controller is shown in the Status Word (Table 3). Whether the drive is initialized, or an error or warning is active, or the drive is at the target position, etc.

StateVar: The StateVar (Table 5) shows the state of the controller (Operation Enabled: 8, Homing: 9, Error: 4 etc.). In State 4 (Error), the error code is shown in the 8 least significant bits. In State 8 (Operation Enabled), the 4 least significant bits show the Command Count. The StateVar is needed for synchronization of motion commands via fieldbusses.

MC Interface: Over the motion command interface (Table 4) all available motion commands can be sent to the controller. In this example a „VAI Go To Position“-command with the parameters target position, maximum velocity, acceleration an deceleration.

Control Word	
Bit	**Name**
0	Switch On
1	Voltage Enable
2	/Quick Stop
3	Enable Operation
4	/Abort
5	/Freeze
6	Go To Position
7	Error Acknowledge
8	Jog Move +
9	Jog Move -
10	Special Mode
11	Home
12	Clearance Check
13	Go To Initial Position
14	Reserved
15	Phase Search

Status Word	
Bit	**Name**
0	Operation Enabled
1	Switch On Active
2	Enable Operation
3	Error
4	Voltage Enable
5	/Quick Stop
6	Switch On Locked
7	Warning
8	Event Handler Active
9	Special Motion Active
10	In Target Position
11	Homed
12	Fatal Error
13	Motion Active
14	Range Indicator 1
15	Range Indicator 2

Table 3: Control and Status Word

MC Interface: „VAI Go To Position (010xh)“ Befehl				
Name	**Byte Offset**	**Description**	**Data Type**	**Unit**
Header	0	010xh: VAI Go To Pos	UInt16	-
1.Par	2	Target Position	SInt32	0.1 um
2.Par	6	Maximal Velocity	UInt32	10^{-6} m/s
3.Par	10	Acceleration	UInt32	10^{-5} m/s^2
4.Par	14	Deceleration	UInt32	10^{-5} m/s^2

Table 4: Motion Command Interface (Here with VAI Go To Position command)

StateVar															
Main State								Sub State							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

00: Not Ready To Switch On	0
01: Switch On Disabled	0
02: Ready To Switch On	0
03: Setup Error	Error Code which will be logged
04: Error	**Logged Error Code**
05: HW Tests	0 (Not yet defined)
06: Ready To Operate	0 (Not yet defined)
07: -	
08: Operation Enabled	**Bits 0..3: Motion Command Count** **Bit 4: Event Handler Active** **Bit 5: Motion Active** **Bit 6: In Target Position** **Bit 7: Homed**
09: Homing	**0Fh: Homing Finished**
10: Clearance Check	0Fh: Clearance Check Finished
11: Going To Initial Position	0Fh: Going To Initial Position Finished
12: Aborting	Not yet defined
13: Freezing	Not yet defined
14: Quick Stop Behaviour	Not yet defined
15: Going To Position	0Fh: Going To Position Finished
16: Jogging +	01h: Moving positive 0Fh: Jogging + Finished
17: Jogging -	01h: Moving negative 0Fh: Jogging – Finished
18: Linearizing	Not yet defined
19: Phase Search	Not yet defined
20: Special Mode	Not yet defined

Table 5: StateVar

Procedure

Before a command is sent, a check must be made that the controller is in State 8 (Operation Enabled) (high byte of StateVar = 08h) and has been referenced (Homed: Bit 11 of the Status Word, or Bit 7 of StateVar).

Also, it must be noted that the controller executes a command only if the Command Count of the Command Header (4 least significant bits) is not equal to the Command Count in StateVar (4 least significant bits). In the simplest case, bit 0 in the Command Header is set to 0 or 1 alternately from command to command (toggled).

Example:

1. Operation Enabled? (High byte of the StateVar = 08h)
2. Motor referenced? (Bit 11 of the Status Word or Bit 7 of the StateVar is set)
3. Send position command 1 (Command Header = 010**1**h, Command Count = **1**)
4. Motor in Position? (Bit 10 of the Status Word or Bit 6 of the StateVar is set)
5. Send position command 2 (Command Header = 010**0**h, Command Count = **0**)
6. Motor in Position? (Bit 10 of the Status Word or Bit 6 of the StateVar is set)

On the application: The following shows how to move to the positions from the application in order, and what must be checked before and after sending a command.

1. Check
Is the controller in state 8? (High byte of StateVar = 08h)
Is the motor referenced? (Bit 11 of the Status Word or Bit 7 of StateVar is set)

2. Send motion command to 20mm with v = 1m/s and a=10m/s². Set 1h as Command Count in the header

Word	Description	Example (values hexadecimal)		Unit
0	Command Header with ID	010**1**h	VAI Go To Position, 1 = Command Count	-
1-2	1. Command Parameter	00030D40h	Position, 50mm	0.1 um
3-4	2 Command Parameter	000F4240h	Maximum velocity, 1m/s	10^{-6} m/s
5-6	3. Command Parameter	000F4240h	Acceleration, 10m/s²	10^{-5} m/s²
7-8	4. Command Parameter	000F4240h	Deceleration, 10m/s²	10^{-5} m/s²

3. Check
Has the command been completed by the controller? Bit 0-3 of StateVar (Command Count) = **1**h
Is the motor at the target position? Bit 10 of the Status Word or Bit 6 in low byte of the StateVar is set
Is the controller in state 8? (High byte of StateVar = 08h) or is there an error? (High byte of StateVar = 04h or Bit 3 of the Status Word is set)

4. Send motion command to 80mm with v = 0.2m/s and a=1m/s². Set 2h as Command Count in the header

Word	Description	Example (values hexadecimal)		Unit
0	Command Header with ID	010**2**h	VAI Go To Position, 2 = Command Count	-
1-2	1. Command Parameter	000C3500h	Position, 80mm	0.1 um
3-4	2 Command Parameter	00030D40h	Maximum velocity, 0.2m/s	10^{-6} m/s
5-6	3. Command Parameter	000186A0h	Acceleration, 1m/s²	10^{-5} m/s²
7-8	4. Command Parameter	000186A0h	Deceleration, 1m/s²	10^{-5} m/s²

5. Check	
	Has the command been completed by the controller? Bit 0-3 of StateVar (Command Count) = **2**h
	Is the motor at the target position? Bit 10 of the Status Word or Bit 6 in low byte of the StateVar is set
	Is the controller in state 8? (High byte of StateVar = 08h) or is there an error? (High byte of StateVar = 04h or Bit 3 of the Status Word is set)

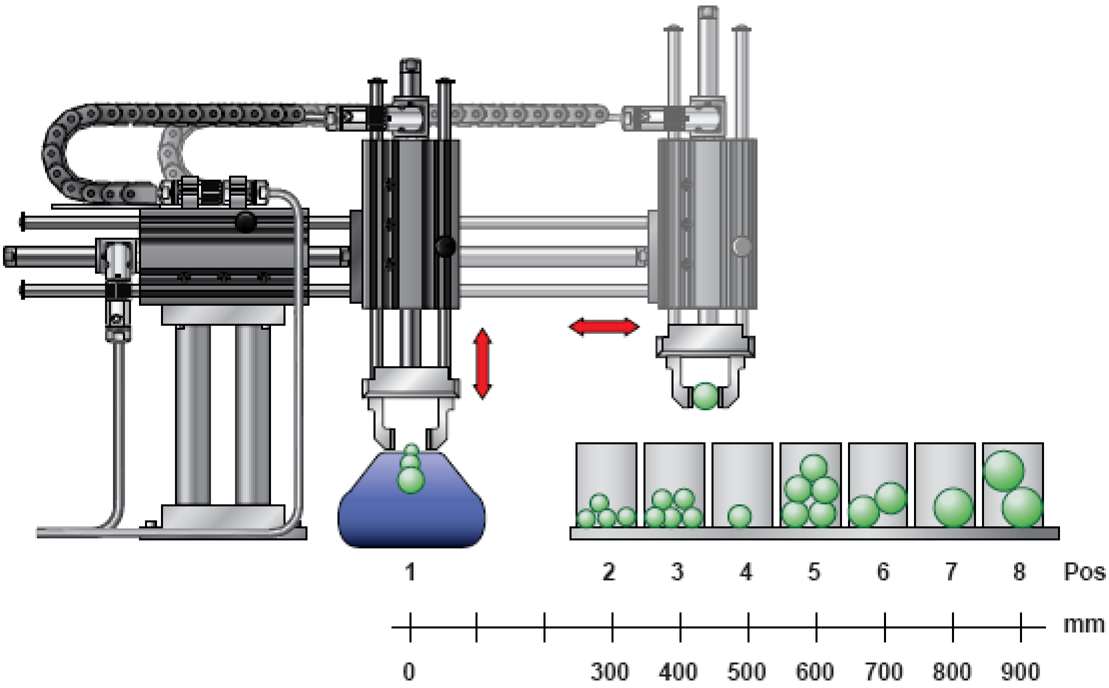
6. Send motion command to 0mm with v = 2.5m/s and a=30m/s². Set 3h as Command Count in the header

Word	Description	Example (values hexadecimal)		Unit
0	Command Header with ID	010**3**h	VAI Go To Position, 3 = Command Count	-
1-2	1. Command Parameter	00000000h	Position, 0mm	0.1 um
3-4	2 Command Parameter	002625A0h	Maximum velocity, 2.5m/s	10^{-6} m/s
5-6	3. Command Parameter	002DC6C0h	Acceleration, 30m/s²	10^{-5} m/s²
7-8	4. Command Parameter	002DC6C0h	Deceleration, 30m/s²	10^{-5} m/s²

6. Check	
	Has the command been completed by the controller? Bit 0-3 of StateVar (Command Count) = **3**h
	Is the motor at the target position? Bit 10 of the Status Word or Bit 6 in low byte of the StateVar is set
	Is the controller in state 8? (High byte of StateVar = 08h) or is there an error? (High byte of StateVar = 04h or Bit 3 of the Status Word is set)

6. Moving To 8 (E1100) / 5 (B1100) Positions Using Digital I/O's

E1100 AND B1100

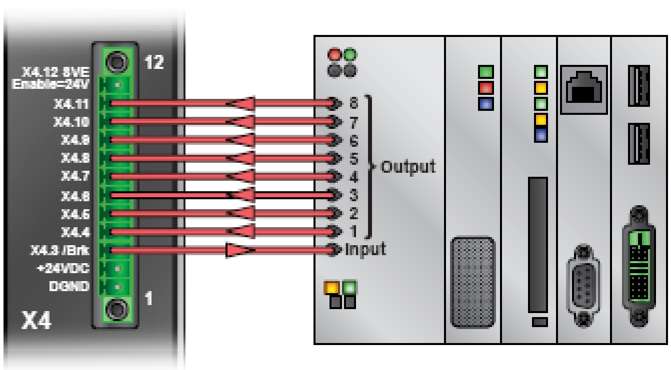


Application

In an application, a product is to be sorted by size and placed accordingly in up to 7 (E1100) / 4 (B1100) positions. The PLC used has only digital I/Os. Eight positions are required. One starting position, at which the products are picked up, and 7 positions for placement. The 8 / 5 positions are to be invoked by 8 / 5 individual digital input signals. As soon as the required position is reached, this is to be indicated by an InPosition output. Travel to the placement locations has to be more slow (0.2 m/s, 2 m/ s^2), while the return travel to the starting position has to be fast (1 m/s, 10 m/s^2).

Solution

The application is solved using Easy Steps. Easy Steps is a simple application to use, in which one configurable travel command is initiated for a rising edge at each of the inputs X4.4 to X4.11 (E1100) / X14.2 to X14.4 (B1100). Easy Steps is a software application and has to be installed during firmware installation. ("File -> Install Firmware")



Configuration

Function	Value	E1100 (UPID)	B1100 (UPID)	Description
In Position Output		\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions		
Status Word: In Target Position (Output)	On	1036h	62EEh	X4.3 / X14.17 as InPosition
Position 1, X4.4 (E1100) / X14.2 (B1100)		\Parameters\Easy Steps\IO Motions\Input X*.* Config		
Goto Abs Position	On	3500h	6418h	Command on rising edge
Position	0mm	3510h	F208h	Position 1
Max. Speed	1m/s	3511h	F209h	Maximum velocity
Acceleration	10m/s²	3512h	F20Ah	Acceleration
Deceleration	10m/s²	3513h	F20Bh	Deceleration
Position 2, X4.5 (E1100) / X14.15 (B1100)		\Parameters\Easy Steps\IO Motions\Input X*.* Config		
Goto Abs Position	On	3600h	6428h	Command on rising edge
Position	200mm	3610h	F210h	Position 2
Max. Speed	0.2m/s	3611h	F211h	Maximum velocity
Acceleration	2m/s²	3612h	F212h	Acceleration
Deceleration	2m/s²	3613h	F213h	Deceleration
Further positions				
Same as X4.4 and X4.5 (E1100) / X14.2 and X14.15 (B1100)				

Note B1100 Controller

The B1100 series controllers for each input a separate “In Target Position” output can be set. This function is called “Linked Output Mode” and can be found in the Easy Steps parameter tree.
E.g. for input X14.2 the associated “Linked Output” is X14.5.

Path: *\Parameters\Easy Steps\IO Motions\Input X14.* Config\X14.* Linked Output Mode*

7. Sequence Control

E1100 AND B1100-GP*

Application

Foam rubber squares are tested in a machine. A linear motor is to compress the square with a force of 40 N. After 2 seconds of press time, the square is measured to see if it is within tolerance.

The entire sequence is to be started by a trigger signal. If the square is in spec, this is to be indicated at a digital output. The same applies if it is defective.
As motor a PS01-37x240 is used.

This is done in the following sequence:	
1.	Move linear motor to 40 mm position, with v = 3 m/s and a = 5 m/s^2
2.	Reduce force to 40 N and press squares together at a speed of 0.05 m/s
3.	Press for 2 seconds
4.	Check the tolerances: If the linear motor is at a position that is greater than 65 mm and less than 75mm, then the square is in spec; otherwise, it is defective.
5.	Return to start position at 0mm mm, with v = 0.5 m/s and a = 5 m/s^2

Solution

The Command Table is provided for this application. This allows programming of sequences, from the simplest to complex, using various motion commands, conditions, branches, parameter access, …

The command table for the required sequence is created with the LinMot-Talk1100 software, and is loaded into the controller. The trigger signal is wired to X4.6. If the square is in tolerance, then this is indicated at X4.8 (OK); if it is outside the tolerance, this is indicated at X4.7 (Defect).

In order to limit the linear motor force to 40 N, the maximum current has to be limited. The model PS01-37x240 motor has a force constant of 23.8 N/A, which leads to a current of 1.68 A for 40 N (40N / 23.8N/A).

The controller's following error monitor must be deactivated, since the motor will not reach the target position when pressing. This is deliberate in this application.

Note B1100-GP Controller

* The B1100-GP controller supports the command table too. But there are some limitations like less usable commands and a limit of 31 command lines. The configuration of the B1100-GP controller is not shown in this example but can be realized as on the E1100 series controllers.

More detailed descriptions of the usable commands as well as the command table can be found in the user manual "Motion Control SW".

Configuration

Hardware Interface
Trigger signal at X4.6 (Input)
Error signal at X4.7 (Output)
OK signal at X4.8 (Output)

Function	Value	E1100 (UPID)	Description
Configure RunMode	\Parameters\Motion Control SW\Motion Interface\RunMode Settings\Run Mode Selection		
Command Table Mode	On	1450h	Run Mode Command Table Mode
Command Table Entry ID	\Parameters\Motion Control SW\Motion Interface\RunMode Settings\Command Table Settings		
Command Table Entry ID	1	1485h	Set command line start ID
Trigger Input	\Parameters\Motion Control SW\Controller Configuration\X4 I/O Definitions		
Trigger (Input)	On	1039h	X4.6 as Trigger
Direct	On	170Ch	Trigger Mode „Direct“

* The trigger mode (Direct, inhibited and/or delayed) and the according parameters can be found here:
\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions\Trigger

Error Output	\Parameters\Motion Control SW\Controller Configuration\X4 I/O Definitions		
Interface Output	On	103Ah	X4.7 as Interface Output
OK Output	\Parameters\Motion Control SW\Controller Configuration\X4 I/O Definitions		
Interface Output	On	103Bh	X4.8 as Interface Output
Deactivating following error monitoring	\Parameters\Motion Control SW\Errors & Warnings\Error Detection Mask		
Position Lag Always	False	1587h	Turn off general following error
Position Lag Standing	False	1588h	Turn off following error at rest

Create Command Table \Command Table

Upload from Controller | Download to Controller

ID	Name	Type	Par 1	Par 2	Par 3	Par 4	Sequenced Entry
1	Warte Trigger	Wait until Rising Trigger Edge					2 (Fahre Pos 40mm)
2	Fahre Pos 40mm	VAI Go To Pos	Pos: 40 mm	Vel: 3 m/s	Acc: 5 m/s^2	Dec: 5 m/s^2	3 (Warte InPosition)
3	Warte InPosition	Wait until In Target Position					4 (Fahre Pos 90mm)
4	Fahre Pos 90mm	VAI Go To Pos	Pos: 100 mm	Vel: 0.05 m/s	Acc: 2 m/s^2	Dec: 2 m/s^2	5 (Kraft reduzieren)
5	Kraft reduzieren	Write Live Parameter	UPID: 13A6h (Maximal Current)	Value: 1.68 A			6 (Kraft erreicht?)
6	Kraft erreicht?	IF Current Greater Than	Val: 1.67 A	True Cmd ID: 10 (Presse 2s)	False Cmd ID: 7 (Dummy)		None
7	Dummy	No Operation					8 (Pos > 99 mm?)
8	Pos > 99 mm?	IF Actual Position Greater Than	Val: 99 mm	True Cmd ID: 14 (Set Error X4.7)	False Cmd ID: 6 (Kraft erreicht?)		None
9							
10	Presse 2s	Wait Time	Time: 2000 ms				11 (Pos kleiner 65?)
11	Pos kleiner 65?	IF Actual Position Less Than	Val: 65 mm	True Cmd ID: 14 (Set Error X4.7)	False Cmd ID: 12 (Pos grösser 75?)		None
12	Pos grösser 75?	IF Actual Position Greater Than	Val: 75 mm	True Cmd ID: 14 (Set Error X4.7)	False Cmd ID: 15 (Set OK X4.8)		None
13							
14	Set Error X4.7	Write Live Parameter	UPID: 1C89h (X4 Intf Outputs)	Value: 00000010h			17 (Fahre Pos 0mm)
15	Set OK X4.8	Write Live Parameter	UPID: 1C89h (X4 Intf Outputs)	Value: 00000020h			17 (Fahre Pos 0mm)
16							
17	Fahre Pos 0mm	VAI Go To Pos From Act Pos And Act Vel	Pos: 0 mm	Vel: 0.5 m/s	Acc: 10 m/s^2	Dec: 10 m/s^2	18 (Normale Kraft)
18	Normale Kraft	Write Live Parameter	UPID: 13A6h (Maximal Current)	Value: 8 A			19 (Warte InPosition)
19	Warte InPosition	Wait until In Target Position					20 (Reset Ausgänge)
20	Reset Ausgänge	Write Live Parameter	UPID: 1C89h (X4 Intf Outputs)	Value: 00000000h			1 (Warte Trigger)
21							

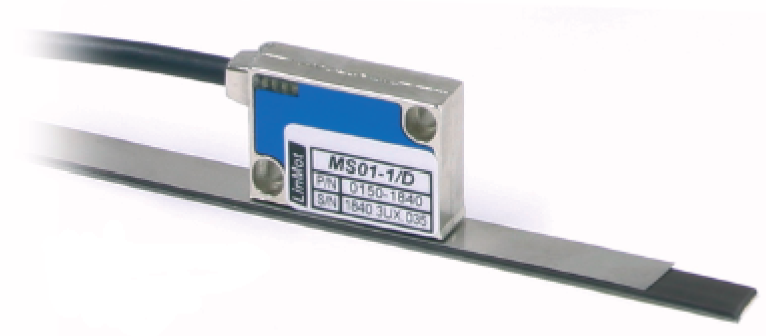
Finally save the command table on the controller -> „Download to Controller“

8. High-Precision Positioning

E1100 AND B1100

Application

For a high-precision positioning application, the position of the linear motor should be measured by an external high-resolution sensor to improve positioning accuracy.



Solution

E1100 / B1100 series controllers support the integration of an external position sensor at X12 (E1100) / X13 (B1100). In this example, an AB linear encoder, Model MS01-1/D (LinMot Item No. 0150-1840) with a resolution of 1µm is used.

Configuration

Hardware Interface
Connect the external sensor to X12 / X13 (Check pin assignment –> Installation Guides)

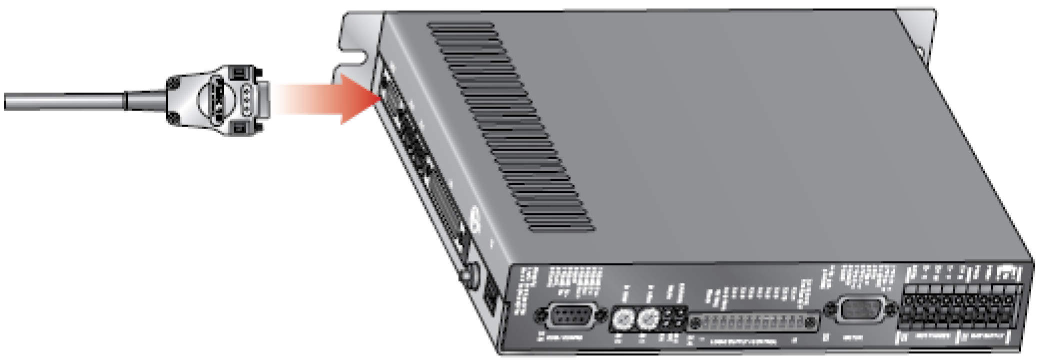
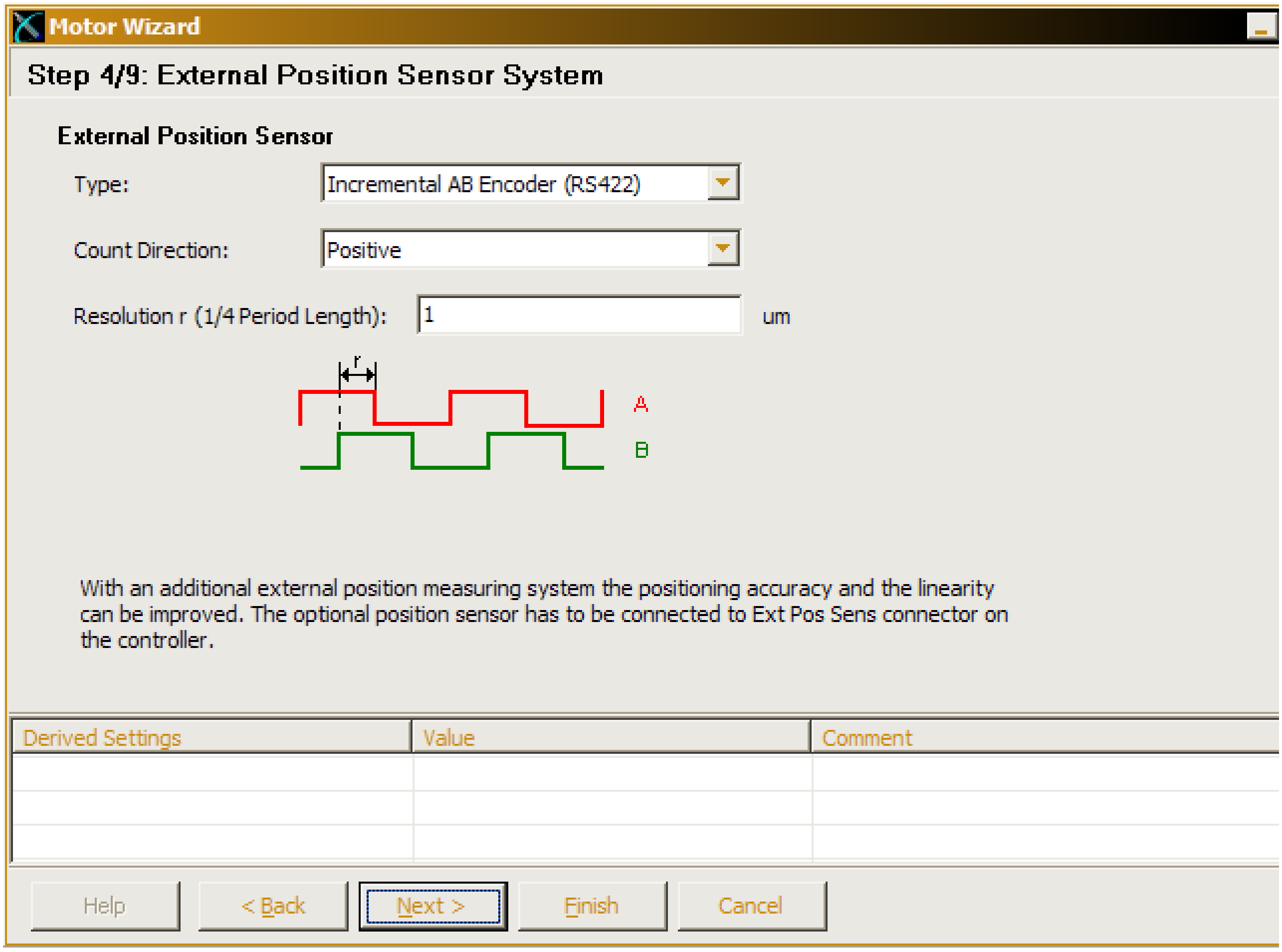


Figure 7: X12 connector on E1100 controller

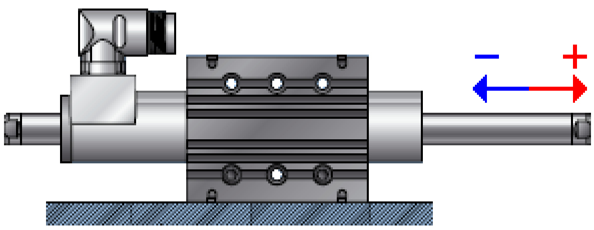
Sensor configuration	Motor Wizard > Schritt 4
Open the Motor Wizard -> Step 4, "External Position Sensor"	



Type: The MS01-1/D is an AB Sensor
Count Direction: Positive or Negative
Resolution: 1um
Further settings are available under \Parameters\Motor Configuration\Position Feedback\Feedback on X*.*"

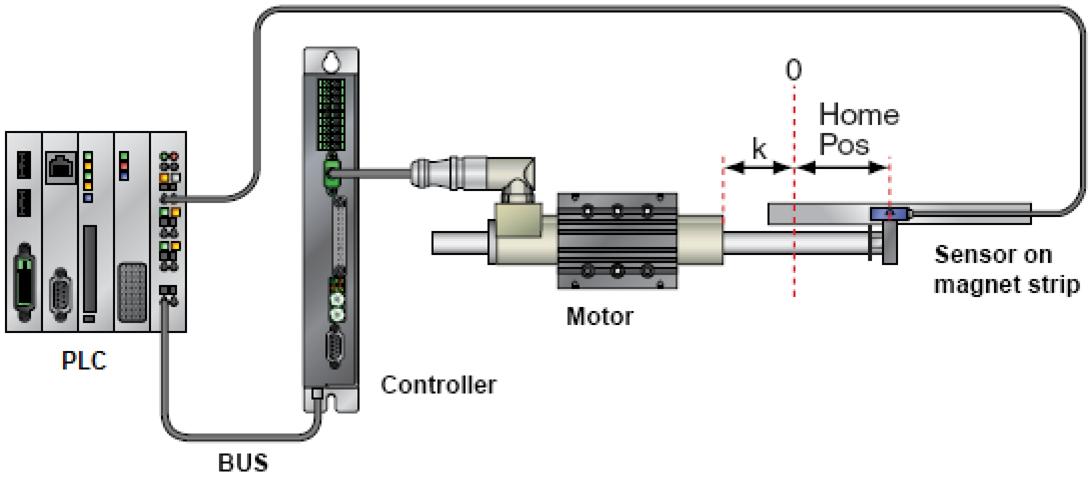
Note

After configuring the external sensor, the count direction should be checked as follows. First, start the firmware, and then move the slider by hand. While doing this, observe the position in the LinMot-Talk1100 control panel. When the slider is being pulled out of the stator, then the actual position should count in the positive direction



9. Operation With An External Absolute Sensor

E1100 AND B1100



Application

In a complex application, it is not possible to move the linear motor for referencing. For this reason, an absolute sensor is used to determine the position of the linear drive.

Solution

The signal from the absolute sensor is fed to the PLC. In order for the linear motor to compensate for boundary effects, and achieve optimal position control, the location of the slider relative to the stator must be known at the time of initialization. Since the current position of the absolute sensor is sent to the controller by the PLC, a serial interface or fieldbus connection is needed.

Configuration

Function	Value	E1100 (UPID)	B1100 (UPID)	Description
Set Homing Mode				\Parameters\Motion Control SW\State Machine Setup\Homing
Actual Position	On	13C4h	61E8h	Homing-Mode “Actual Position”
Disable	On	13D8h	61F3h	Deactivate Auto on Homing

Sequence to initialize the drive	
1.	Turn on controller
2.	Enable Motor
3.	PLC reads current position of the absolute sensor
4.	Write home position (current position of the absolute sensor) UPID 13C7h (E1100) / F0F5h (B1100)
5.	Write Slider Home Position (see below) UPID 13CAh (E1100) / F0F8h (B1100)
6.	Homing to Actual Position (set Bit 11 in the Control Word)
7.	As soon as Bit 11 (Homed) in the Status Word is set, erase Bit 11 in the Control Word again
8.	Drive is ready

Determining the Slider Home Position
In order to ensure correct initialization of the drive, it must first be determined how far the slider extends out of the stator (= **distance k**) when the absolute sensor is at the zero position. (See illustration)
The **Slider Home Position** that must be written in Step 5 is the **current position** of the absolute sensor **plus** the **distance k**.

Note

If changes are made to the mechanics, then k may need to be determined again.

10. Setting A Brake

E1100 and B1100

Application

A linear drive is installed vertically. In order to prevent the axis from falling down in case of an error or loss of power, a mechanical brake should be used to hold the axis in position when the motor is turned off.

Solution

E1100/B1100 series controllers support the control of an external brake. X4.3 (E1100) / X14.17 (B1100) can be configured for use as a brake output, with a maximum output current of 1A. The brake uses the no-signal current principle. I.e., it is vented when voltage is applied. In case of a fault, the inverted brake output goes to OFF, and the brake is applied. The controller brake output is therefore connected inversely (operation enabled: X4.3 = 1, motor current less: X4.3 = 0).

Generally errors that occur during a motion initiate a QuickStop, which immediately stops the motor. If the QuickStop ends, then the motor is no longer under position control; i.e., the motor current is 0 (zero) → brake is active.

Configuration

Hardware Interface
Brake output to valve is connected on X4.3 (E1100) / X14.17 (B1100)

Function	Value	E1100 (UPID)	B1100 (UPID)	Description
Brake Output		\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions		
Brake (Ouput)	On	1036h	62EEh	Brake output on X4.3 / X14.17

Brake Mode		\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions\Brake X*.*		
Status Word: Operation Enabled	True	1717h	43D5h	
Quick Stop	True	1716h	43D6h	
Apply Delay Time	100ms	171Bh	6209h	Set as needed
Release Delay Time	50 ms	171Ch	620Ah	Set as needed

Apply Delay Time:
Motor cutoff is delayed until the brake has been applied.
Release Delay Time:
Brake release is delayed until the active position control is working.

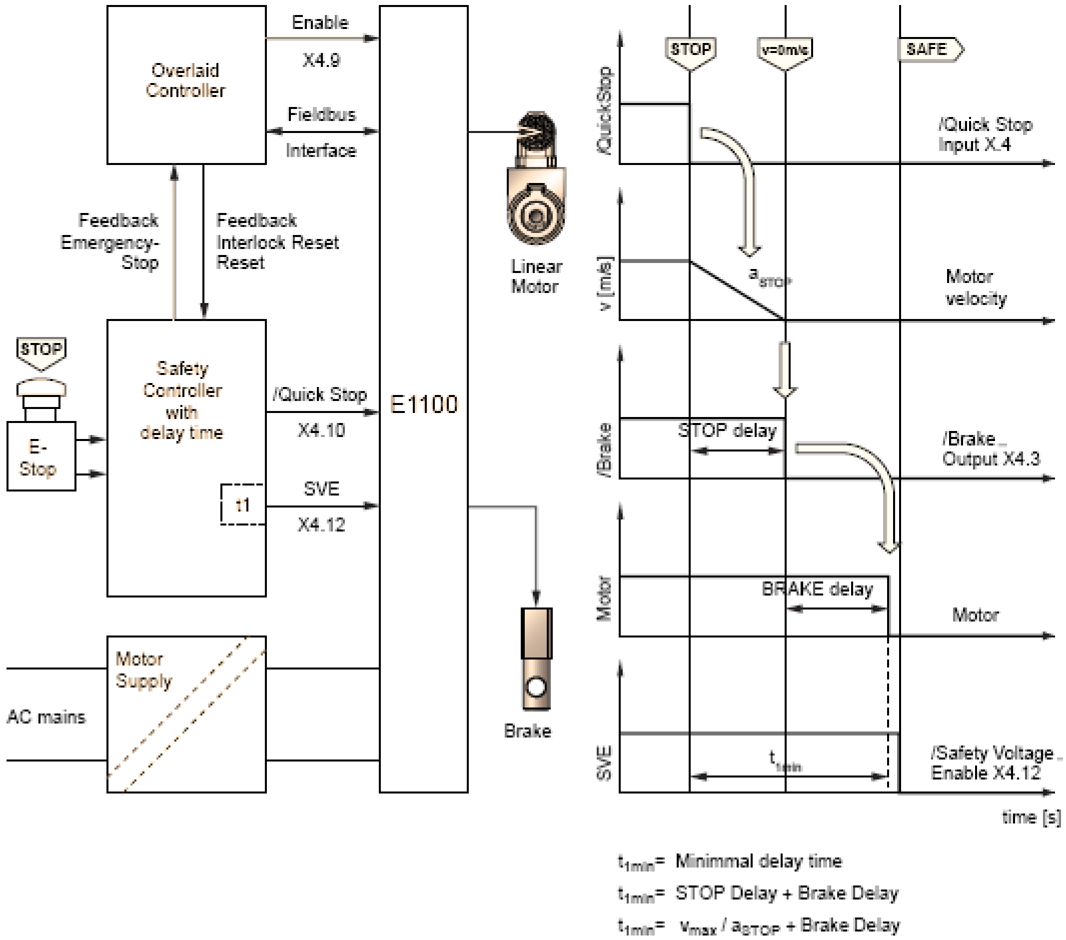


Figure 8: Signal sequence in case of a QuickStop

Note

In order to be able to initiate a QuickStop externally (digital I/O, field bus), UPID 13EEh (E1100) / 4282h (B1100) must be set to "False."

11. Safe Pulse Inhibitor

ONLY E1100

The safe pulse inhibitor (Safety Voltage Enable) is a safety function. The PWM generator in the power electronics is hardware enabled only after the Safety Voltage Enable input (X4.12) is high (+24V).

The diagram below shows a wiring suggestion for implementing a Category 3 "safe stop" per EN954-1, with controlled shutdown (Stop 1 per DIN EN60204-1).

The safety function SVE fulfills the following criteria of the new machine directive EN ISO 13849-1:

• Category	cat = 3
• Performance Level	PL = d
• Diagnostic Coverage	DC = medium
• Mean time to hazardous failure of one channel	MTTFd = 49.8 Years

As soon as the pulse enable is inhibited by the SVE signal, the final stage of the power supply is safely switched off without any delay. The pulse enable is provided as an external terminal. The servo controller divides it into two independent signals internally. The external wiring must be done in such a way as to prevent shorting to other current-carrying components.

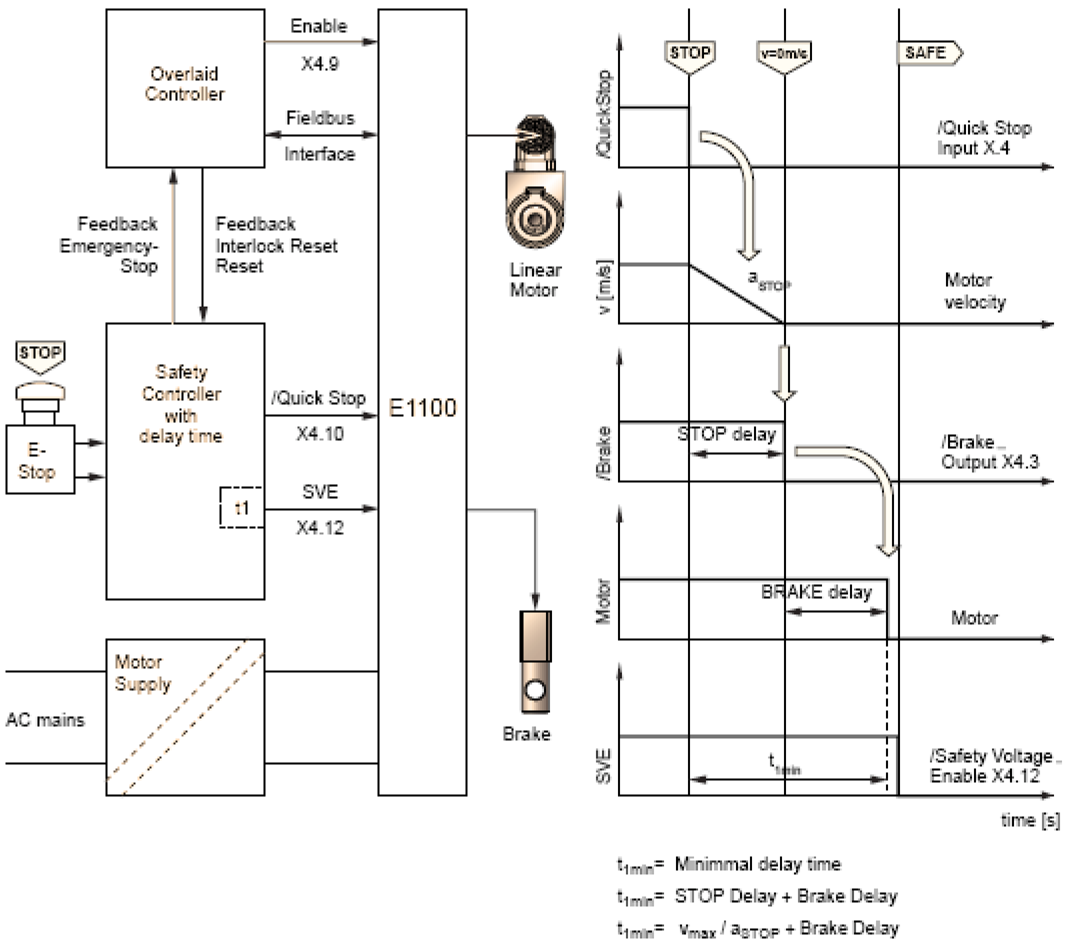
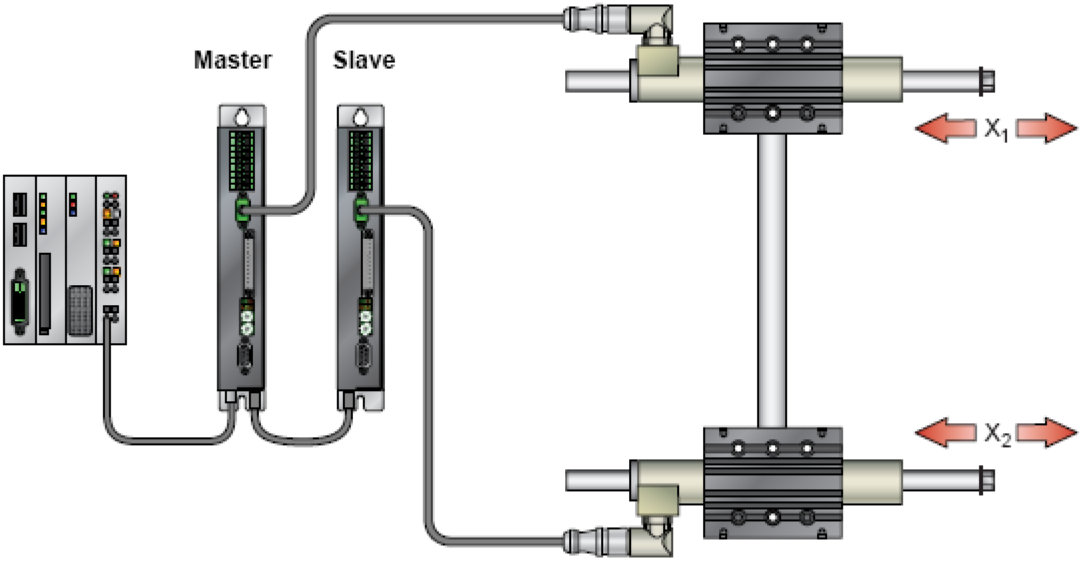


Figure 9: "Safe stop" wiring suggestion

12. Parallel Operation Of Two Motors (Master / Gantry)

ONLY **E1100**



Application

A portal with two parallel X-axis is to be constructed. The two motors should move in parallel, and be able to be controlled as a single axis by the overarching controller.

Solution

For this application, the LinMot controllers provide master slave application software with a "Master Gantry" function. Two E1100 series controllers are connected to each other using connector X7/X8 or X10/X11 (E1100-GP).

One controller is configured as the master, and is addressed by the overarching controller, and the other is configured as a slave, and receives the required target position from the master. Both motor positions are controlled independently of each other. The slave controller is initialized in parallel with the master.

⚠ In gantry operation, the motors are located a certain distance apart, and must therefore **not** be 100% rigidly coupled!

Configuration

The motor must be configured on both controllers (Motor Wizard)
Installation of the master-slave application on both controllers: Install firmware and choose „Master Slave“ as application
Connect both controller via CAN Bus (connector X7/X8) with an Ethernet cable per EIA / TIA 568A (Item No. 0150-1853). Set CAN-Term S3.3 to ON for both controllers.

Function	Value	E1100 (UPID)	Description
Configuration Master			\Parameters\Master Slave Application\
CAN	On	3EF7h	Select CAN as the interface
Gantry Master	On	30D4h	Configure controller as Gantry Master
Configuration Slave			\Parameters\Master Slave Application\
CAN	On	3EF7h	Select CAN as the interface
Gantry Slave	On	30D4h	Configure controller as Gantry Slave
Normal *	On	30E2h	Select the direction of the slave drive

* Normal = both stators are oriented in the same direction

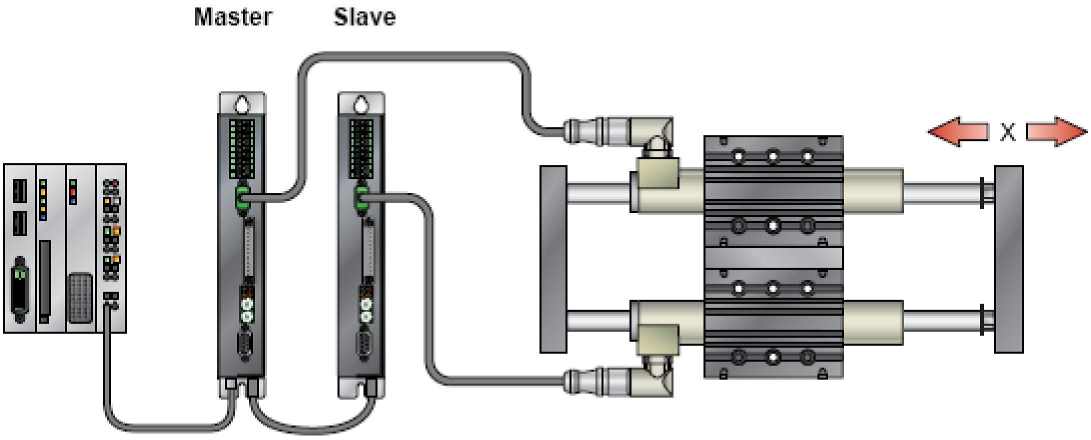
Note

Instead of CAN also RS485 can be used as connection between master and slave (set UPID 3EF7h to RS 485)

Additional information can be found in the user manual „Master Slave Application“.

13. Force Doubling (Master / Booster)

ONLY **E1100**



Application

A tool is to be moved horizontally in an assembly fixture. In order to increase dynamics and force, two motors are to be operated in parallel. The two motors should be able to be controlled as a single axis by the overarching controller.

Solution

For this application, the LinMot controllers provide master-slave application software with a "Master Booster" function. Two E1100 series controllers are connected to each other using connector X7/X8 or X10/X11 (E1100-GP).

One controller is configured as the master, and is addressed by the overarching controller, and the other is configured as a slave, and receives the calculated target current from the master (slave position is not controlled). The slave controller is initialized in parallel with the master.

⚠ In booster operation, the motors must be rigidly coupled.

Configuration

The motor must be configured on both controllers (Motor Wizard)
Installation of the master-slave application on both controllers: Install firmware and choose „Master Slave“ as application
Connect both controller via CAN Bus (connector X7/X8) with an Ethernet cable per EIA / TIA 568A (Item No. 0150-1853). Set CAN-Term S3.3 to ON for both controllers.

Function	Value	E1100 (UPID)	Description
Configuration Master			\Parameters\Master Slave Application\
CAN	On	3EF7h	Select CAN as the interface
Current Master	On	30D4h	Configure controller as Current Master

Configuration Slave			\Parameters\Master Slave Application\
CAN	On	3EF7h	Select CAN as the interface
Current Slave	On	30D4h	Configure controller as Current Slave
Normal *	On	30E2h	Select the direction of the slave drive

* Normal = both stators are oriented in the same direction

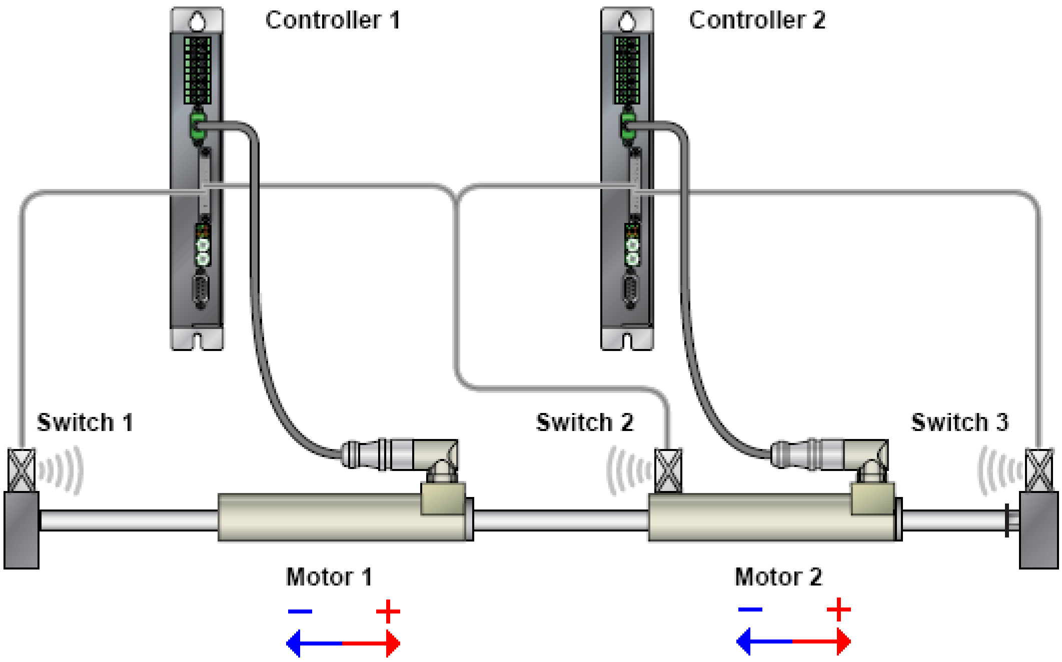
Note

Instead of CAN also RS485 can be used as connection between master and slave (set UPID 3EF7h to RS 485)

Additional information can be found in the user manual „Master Slave Application“.

14. Evaluation Of End Positions And Reference Switches

E1100 AND B1100



Application

Two LinMot drives move independently on the same slider. In order to prevent collisions, an end position switch (switch 2) is mounted on one stator. When this switch is activated, it means that the distance between the two stators has become too close, and the motors must be immediately stopped. In addition, two additional end switches are installed at the two end positions (switches 1 and 3).

Solution

End switches can be connected to the X4.8 and X4.9 (E1100) / 14.3 and 14.16 (B1100). If one of these end switches is activated, then the motor is immediately stopped by a Quick Stop.

Configuration

Hardware Interface
Connect switch 1 to X4.8 / X14.3 on Controller 1
Connect switch 2 to X4.9 / X14.16 on Controller 1 and X4.8 / X14.3 on Controller 2
Connect switch 3 to X4.9 / X14.16 on Controller 2

Function	Value	E1100 (UPID)	B1100 (UPID)	Description
Configuration Controller 1		\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions		
Limit Switch Negative (Input)	On	103Bh	62EBh	X4.8 / X14.3 as limit switch neg
Limit Switch Positive (Input)	On	103Ch	62ECh	X4.9 / X14.16 as limit switch pos
Quick Stop	On	121Bh	61D6h	Error behavior Quick Stop
Deceleration	10 m/s^2	1721h	F144h	Deceleration for Quick Stop

Configuration Controller 2		\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions		
Limit Switch Negative (Input)	On	103Bh	62EBh	X4.8 / X14.3 as limit switch neg
Limit Switch Positive (Input)	On	103Ch	62ECh	X4.9 / X14.16 as limit switch pos
Quick Stop	On	121Bh	61D6h	Error behavior Quick Stop
Deceleration	10 m/s^2	1721h	F144h	Deceleration for Quick Stop

Adapt the end switch logic, if needed (on both cont.)		\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions		
Invert I/O X*.* (low active)	False/True	1050h	43B3h	Logic of X4.8 / X14.3
Invert I/O X*.* (low active)	False/True	1051h	43B4h	Logic of X4.9 / X14.16

15. Press With A Defined Force

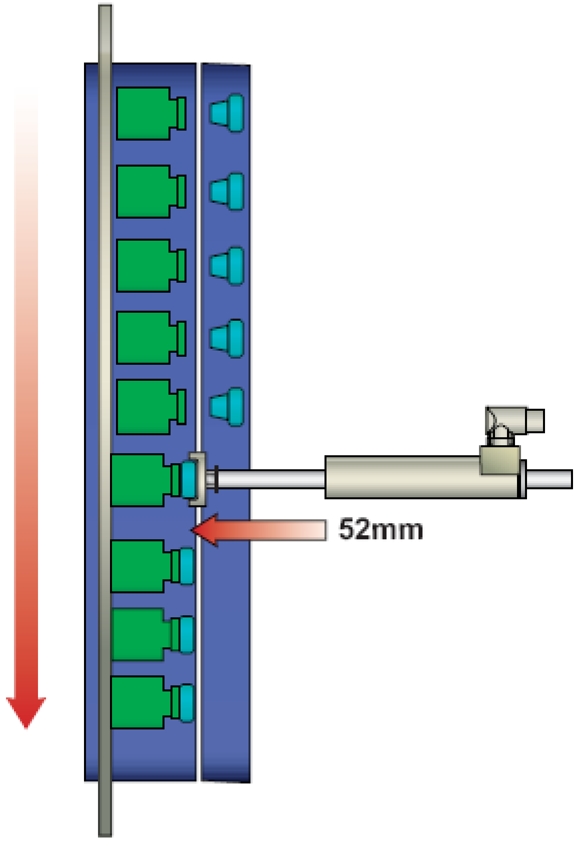
E1100 AND B1100-GP*

Application

In an application, fasteners are inserted. In order to check that the fastener is seated correctly, the end position and the force applied are to be checked.

The required force is 22 N, and the end position is 52mm with a tolerance of +/- 1mm. If the end position is reached, and the force has not been applied after 2s, or if the end position is outside of the tolerance, then an error is to be signaled. Otherwise an OK is signaled. The maximum speed during insertion must not exceed 0.05 m/s.

The check is started by a trigger signal.
A PS01-23x160 motor is used.



Solution

An open loop force control is fundamentally very simple, and is done by limiting the maximum motor current. The resulting force is calculated using the force constant [N/A]. In case of a motor of model PS01-23x160, the force constant is 22.08 N/A. Therefore, a maximum current of 0.996 A must be set in order to press at 22 N.

Note that the maximum permissible current depends on the controller and the motor model used .
The trigger signal and the two digital outputs for the error and OK signals are wired to connector X4.
The required sequence can be realized quite easily using the command table.

Note B1100-GP Controller

* The B1100-GP controller supports the command table too. But there are some limitations like less usable commands and a limit of 31 command lines. The configuration of the B1100-GP controller is not shown in this example but can be realized as on the E1100 series controllers.

More detailed descriptions of the usable commands as well as the command table can be found in the user manual “Motion Control SW”.

Configuration

Hardware Interface
Trigger signal at X4.6 (Input)
Error signal at X4.7 (Output)
OK signal at X4.8 (Output)

Function	Value	E1100 (UPID)	Description
Configure RunMode			\Parameters\Motion Control SW\Motion Interface\RunMode Settings\Run Mode Selection
Triggered Command Table	On	1450h	Run Mode Triggered Command Table
Rise Command Table Entry ID			\Parameters\Motion Control SW\Motion Interface\RunMode Settings\Triggered Command Table Settings
Rise Command Table Entry ID	1	1486h	Set command line start ID
Trigger Input			\Parameters\Motion Control SW\Controller Configuration\X4 I/O Definitions
Trigger (Input)	On	1039h	X4.6 as Trigger
Direct	On	170Ch	Trigger Mode „Direct“

* The trigger mode (Direct, inhibited and/or delayed) and the according parameters can be found here:
\Parameters\Motion Control SW\Controller Configuration\X*.* I/O Definitions\Trigger

Function	Value	E1100 (UPID)	Description
Error Output			\Parameters\Motion Control SW\Controller Configuration\X4 I/O Definitions
Interface Output	On	103Ah	X4.7 as Interface Output
OK Output			\Parameters\Motion Control SW\Controller Configuration\X4 I/O Definitions
Interface Output	On	103Bh	X4.8 as Interface Output
Deactivating following error monitoring			\Parameters\Motion Control SW\Errors & Warnings\Error Detection Mask
Position Lag Always	False	1587h	Turn off general following error
Position Lag Standing	False	1588h	Turn off following error at rest

Create Command Table \Command Table

Upload from Controller | Download to Controller

ID	Name	Type	Par 1	Par 2	Par 3	Par 4	Sequenced Entry
1	Go to Pos 70mm	VAI Go To Pos	Pos: 70 mm	Vel: 0.05 m/s	Acc: 2 m/s^2	Dec: 2 m/s^2	2 (Reduce Force)
2	Reduce Force	Write Live Parameter	UPID: 13A6h (Maximal Current)	Value: 0.996 A			3 (Check Force)
3	Check Force	IF Current Greater Than	Val: 0.99 A	True Cmd ID: 7 (Wait 2s)	False Cmd ID: 4 (Dummy)		None
4	Dummy	No Operation					5 (Check Pos > 53)
5	Check Pos > 53	IF Actual Position Greater Than	Val: 53 mm	True Cmd ID: 14 (Go To Pos 0mm)	False Cmd ID: 3 (Check Force)		None
6							
7	Wait 2s	Wait Time	Time: 2000 ms				8 (Check Pos > 51)
8	Check Pos > 51	IF Actual Position Greater Than	Val: 51 mm	True Cmd ID: 9 (Check Pos < 53)	False Cmd ID: 11 (Set Error X4.7)		None
9	Check Pos < 53	IF Actual Position Less Than	Val: 53 mm	True Cmd ID: 12 (Set OK X4.8)	False Cmd ID: 11 (Set Error X4.7)		None
10							
11	Set Error X4.7	Write Live Parameter	UPID: 1C89h (X4 Intf Outputs)	Value: 00000010h			14 (Go To Pos 0mm)
12	Set OK X4.8	Write Live Parameter	UPID: 1C89h (X4 Intf Outputs)	Value: 00000020h			14 (Go To Pos 0mm)
13							
14	Go To Pos 0mm	VAI Go To Pos From Act Pos And Act Vel	Pos: 0 mm	Vel: 0.5 m/s	Acc: 10 m/s^2	Dec: 10 m/s^2	15 (Std MaxForce)
15	Std MaxForce	Write Live Parameter	UPID: 13A6h (Maximal Current)	Value: 4 A			16 (Wait InPosition)
16	Wait InPosition	Wait until In Target Position					17 (Wait X4.6 = 0)
17	Wait X4.6 = 0	IF Masked X4 Input Value Equal Than	X4 Mask: 0008h	X4 Bit Values: 0000h	True Cmd ID: 19 (Reset Outputs)	False Cmd ID: 18 (Dummy)	None
18	Dummy	No Operation					17 (Wait X4.6 = 0)
19	Reset Outputs	Write Live Parameter	UPID: 1C89h (X4 Intf Outputs)	Value: 00000000h			None

Finally save the command table on the controller -> „Download to Controller“

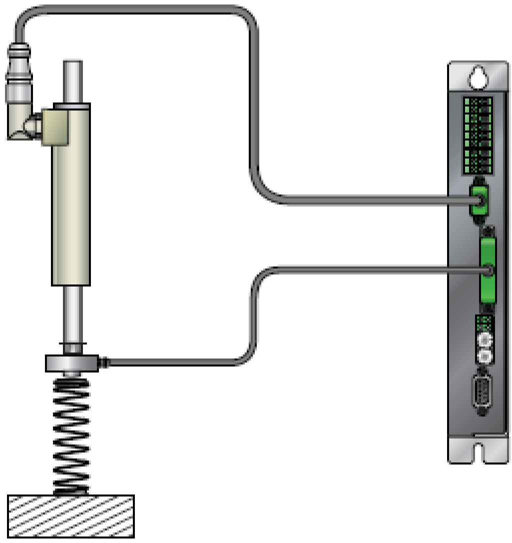
16. Force Control With 0.1 N Resolution

E1100 AND B1100 *

Application

Springs are to be quality tested for force in an automated system. A constant force of 43.2 N must be applied vertically to the springs. Using the internal position measurement, it is determined how far the spring is compressed. Depending on the measured distance, the springs meet the specification.

The applied force is measured by a load cell with a measurement range of 0 to 50 N.



Solution

LinMot provides a technology function with force regulation that allows a precise closed loop control of a constant force across the entire stroke range, regardless of the current position, at a resolution of 0.1 N. Since the force generated by the linear motor is measured by a load cell, and is controlled directly in the servo controller, interference effects, such as differences in friction, dirt, slip-stick effects, temperature variations, and other variables are compensated for. The force determined by the load cell is fed to connector X4.4 as an analog signal (0 to 10V).

Configuration (For B1100-GP see note)

Hardware Interface
The analog signal from the load cell is connected to X4.4

Function	Value	E1100 (UPID)	Description
Configuration of X4.4			\Parameters\Motion Control SW\Controller Configuration\X4 I/O Definitions
Analog Input	On	1037h	X4.4 as analog input
Force	On	1790h	Force signal type

0V Force	\Parameters\Motion Control SW\Controller Configuration\X4 I/O Definitions\Analog In X4.4\Analog Force Feedback Config		
0V Force	0	1501h	Set force at 0V

10V Force	\Parameters\Motion Control SW\Controller Configuration\X4 I/O Definitions\Analog In X4.4\Analog Force Feedback Config		
10V Force	50N	1502h	Set force at 10V

The force control can now be used with the following commands	
VAI Go To Pos With Higher Force Ctrl Limit (380xh)	**Press command**
Travel to a defined target position. As soon as the measured force reaches the force limit, the controller changes to force control mode, with the target force = force limit. To move with position control again, use the command, "VAI Go To Pos From Act Pos And Reset Force Control (381xh)".	
VAI Go To Pos With Higher Force Ctrl Limit And Target Force (383xh)	**Press command**
Travel to a defined target position. As soon as the measured force reaches the force limit, the controller changes to force control mode, with the target force = target force. To move with position control again, use the command, "VAI Go To Pos From Act Pos And Reset Force Control (381xh)".	
VAI Go To Pos With Lower Force Ctrl Limit (384xh)	**Pull command from V3.11**
Travel to a defined target position. As soon as the measured force reaches the force limit, the controller changes to force control mode, with the target force = force limit. To move with position control again, use the command, "VAI Go To Pos From Act Pos And Reset Force Control (381xh)".	
VAI Go To Pos With Lower Force Ctrl Limit And Target Force (385xh)	**Pull command from V3.11**
Travel to a defined target position. As soon as the measured force reaches the force limit, the controller changes to force control mode, with the target force = target force. To move with position control again, use the command, "VAI Go To Pos From Act Pos And Reset Force Control (381xh)".	
Force Ctrl Change Target Force (382xh)	
Using this command, the target force can be changed in force control mode.	
VAI Go To Pos From Act Pos And Reset Force Control (381xh)	
Reactivates position control, and moves to the defined position.	

Detailed descriptions of the commands are found in the Motion Control SW manual.

Note

Force control is a technology function that is ordered separately.
(LinMot Item No. 0150-2503)

Additional information can be found in the user manual “TF Force Control”.

*** Note B1100**

From LinMot-Talk1100 V3.11 the force control is supported by the B1100-GP Controller too.

The settings can be done here:
\Parameters\Motion Control SW\Protected Technology Functions\Analog Force Feedback Control

17. Integration Of Rotary Motors

E1100 AND B1100

Application

A brushless servomotor (EC motor) with a gearbox and spindle are to be used with a LinMot Controller E1130-DP in a profibus system.

The drive is a Faulhaber Motor, model 2036 U 036 B K1155.

The gearbox has a reducing ratio of 3.71:1.

The spindle has a pitch of 1.5mm per revolution.

Solution

E1100 series controllers support the control of 3-phase rotary EC motors. Actuator Definition Files (*.adf) are available for some motor models.

All motors that are currently supported are listed in the user manual "EC_Motors_with_E1100".

Configuration

Connecting the Motor	
Motor phases A, B, C to X2 (Alternatively X3)	A->U, B->V, C->W
Analog Hall-effect sensors A, B, C to X3	A->X3.4, B->X3.9, C->X3.5

Configuration of the Controller
Open the Motor Wizard
Select ADF file: ..\Other Motors\EC Motors\Faulhaber\Faulhaber_EC.adf
Select motor model: 2036 U 036 B K1155
At step 3 of the wizard, the reduction ratio between the motor angle and the position is set. If the controller is provided with a position in mm, then the linear table on the spindle should move to this position. Therefore, the number of millimeters of stroke for each revolution of the motor must be calculated. The nominal reduction of the gearbox is 3.71:1; the pitch of the spindle is 1.5 mm per revolution. Therefore, one revolution of the motor is 1.5/3.71 = 0.4043 mm. This value is entered at "1 revolution = … mm"
Make settings in steps 4 and 5, and close the Wizard.

Note

The same scope of functions that is available for linear motors is also available for controlling rotary motors.

18. Synchronization To A Master Shaft: Master Encoder 0° to 360°

ONLY **E1100**

Application

A linear motor is to execute a motion profile synchronously with a master shaft. The incremental Master Encoder (ABZ) has 512 counts per revolution.

The entire motion profile is to be executed within one revolution of the master shaft (360 machine degrees).

Solution

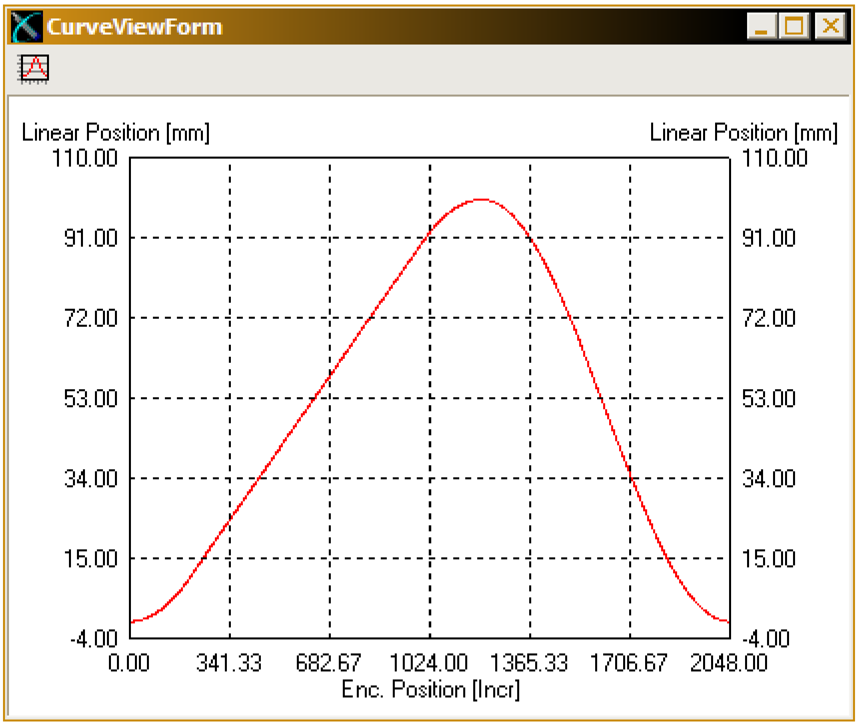
This application is solved using the "CAM Mode" Run Mode. A motion profile can be created and stored in the controller. The motion profile is started after the controller is started up, if the drive has been initialized, the controller is in State 8 "Operation Enabled", and a Z-signal from the encoder is detected for the first time.

Configuration

Creating the motion profile

The encoder signal from the master shaft is evaluated 4 times. This results in 2048 increments per revolution of the master encoder.

In the Curve Inspector in LinMot-Talk1100, the desired motion profile is created as a "CAM (Pos. vs. Enc. Pos.)", with a length of 2048 increments. Instructions for creating curves can be found in the user manual “LinMot-Talk1100”.



The created curve is then loaded into the controller, with ID 1.

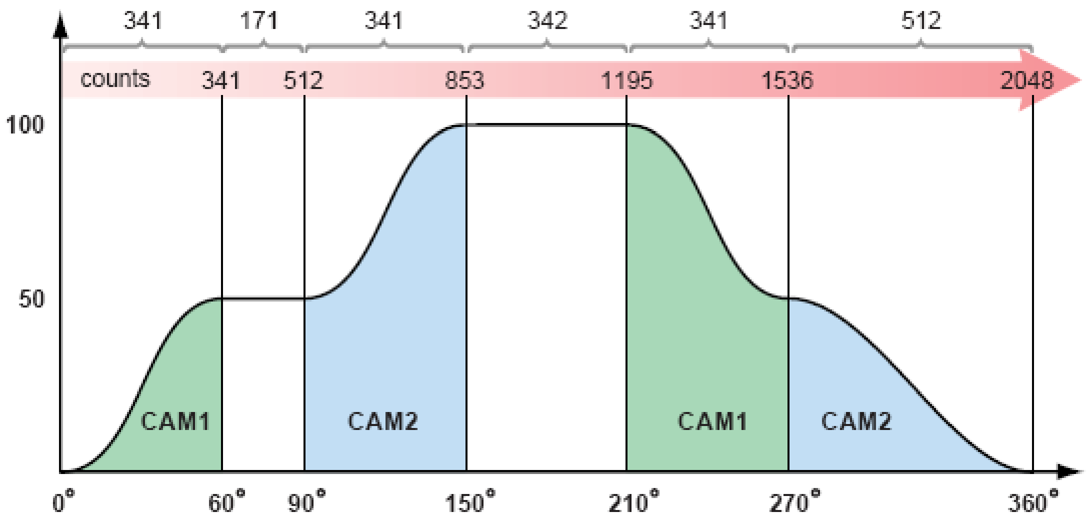
Hardware Interface
The Master Encoder is connected to X12 of the controller.

Function	Value	E1100 (UPID)	Description
Configure RunMode	\Parameters\Motion Control SW\Motion Interface\RunMode Settings\Run Mode Selection		
CAM Mode	On	1450h	Run Mode CAM
Start Counts	0	1523h	Set start offset in counts
Curve ID	1	1524h	Set ID of the curve to be used

Configure Master Encoder	\Parameters\Motion Control SW\Controller Configuration\Master Encoder		
Ext Sensor Input X12	On	172Ah	Master Encoder to X12
ABZ	On	128Eh	Encoder type ABZ
4x	On	128Fh	Decode encoder signals 4 times
CAM Length	2048	1525h	Length of the CAM disc

19. Synchronization To A Master Shaft: CAM1/CAM2

ONLY E1100



Application

In an application, the positions 0mm, 50mm, and 100mm are to be moved to, depending on the machine angle (Position Master Encoder / master shaft). (See illustration above).

Solution

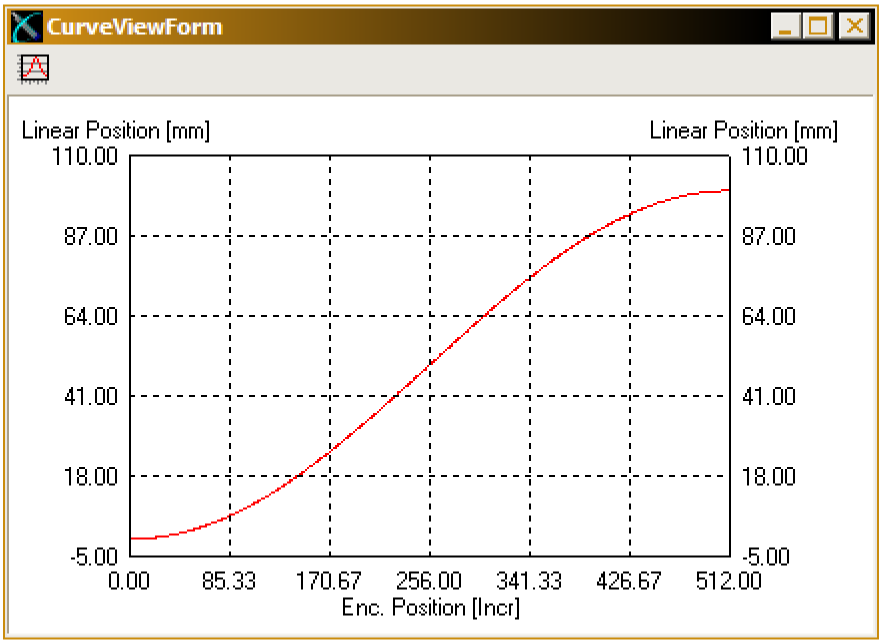
Series E1100 controllers support the definition of two CAMs. This allows loading of a motion profile into a CAM while the motion profile of the other CAM is being run, and vice versa.

The Master Encoder has 512 counts per revolution. The controller is configured such that the encoder signal is decoded 4 times, which results in 2048 increments per revolution.

Configuration

Creating the motion profile

A simple sinusoidal motion profile is needed at first. This is generated in LinMot-Talk1100, and saved to the controller.



Type: CAM (Pos. vs. Enc. Pos.), 0 to 100mm, length: 512 Counts, ID 1

Hardware Interface

The ABZ signal from the Master Encoder is connected to X12 of the controller.

Function	Value	E1100 (UPID)	Description
Configure Master Encoder			\Parameters\Motion Control SW\Controller Configuration\Master Encoder
Ext Sensor Input X12	On	172Ah	Master Encoder to X12
ABZ	On	128Eh	Encoder type ABZ
4x	On	128Fh	Decode encoder signals 4 times
CAM Length	2048	1525h	Length of the CAM disc

Sequence		
1.	**Load the curve into CAM1 using the following command**	
	Encoder CAM 1 Define Curve To Pos In Counts (114xh)	
	Curve ID	1
	Curve Start Count	0 Incr
	Target Position	50 mm
	Curve Length	341 Incr
2.	**Activate CAM mode with command**	
	Encoder CAM Enable (100xh)	
	Now as soon as the first Z-signal is detected from the encoder, the motor will follow the motion profile in CAM1.	
3.	**While the curve in CAM1 is being traveled, CAM2 must be loaded**	
	Encoder CAM 2 Define Curve To Pos In Counts (124xh)	
	Curve ID	1
	Curve Start Count	512 Incr
	Target Position	100 mm
	Curve Length	341 Incr
4.	**While the curve in CAM2 is being traveled, CAM1 must be loaded again**	
	Encoder CAM 1 Define Curve To Pos In Counts (114xh)	
	Curve ID	1
	Curve Start Count	1195 Incr
	Target Position	50 mm
	Curve Length	341 Incr
5.	**While the curve in CAM1 is being traveled, CAM2 must be loaded again**	
	Encoder CAM 2 Define Curve To Pos In Counts (124xh)	
	Curve ID	1
	Curve Start Count	1536 Incr
	Target Position	0 mm
	Curve Length	512 Incr
6.	**While the curve in CAM2 is being traveled, CAM1 must be loaded again for the next revolution of the encoder**	
	Encoder CAM 1 Define Curve To Pos In Counts (114xh)	
	Curve ID	1
	Curve Start Count	0 Incr
	Target Position	50 mm
	Curve Length	341 Incr
7.	**Repeat steps 3 bis 6**	

Note

Motion Commands can be initiated, on one hand, through serial interfaces, fieldbusses, or the Command Table. For practice purposes, however, they can also be transmitted via the Control Panel in LinMot Talk 1100 (Motion Command Interface). Further information can be found in the user manuals "LinMot Talk1100" and "Motion Control SW".

Synchronization and starting up when the Master Encoder is stopped, or (re)synchronization to a running Master Encoder, are described in the "Motion Control SW" user manual, in Chapter 5.3.

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