



BECKHOFF® TwinCAT Programming Example

Control of LinMot® E1250-EC-UC controllers over EtherCAT

Absolute Positioning, Homing, Error Acknowledge, QuickStop and Parameter Access

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Content

Content.....	3
Use of the example.....	3
Recommended documentation.....	3
General.....	4
Hardware configuration.....	5
Interface.....	7
Test program.....	11
Contact.....	12

Use of the example

The function block for Beckhoff TwinCAT is a programming example for LinMot E1250-EC-UC controllers. The example is provided by LinMot free of charge. There is no demand of warranty and updates for the user. Also liability is explicit excluded for damages that may be caused by using this examples.

Controller:	E1250-EC-UC
Classification:	<input type="checkbox"/> LinMot internally <input checked="" type="checkbox"/> Dissemination to customers allowed
Approval:	<input checked="" type="checkbox"/> Programming example <input type="checkbox"/> Use in productive environments

Recommended documentation

Reading the following user manuals is needed for the understanding of the communication between the PLC and the E1250-EC-UC controller. The manuals are included in LinMot-Talk1100 or can be downloaded from <http://www.linmot.com/index.php?id=83>

- user manual "Motion Control SW"
- user manual "EtherCAT Interface"
- user manual "LinMot-Talk1100"

General

The LinMot E1250-EC-UC controllers can be connected over EtherCAT to a Beckhoff TwinCAT PLC. To simplify the integration of the controller into the PLC program and to show the general control the available examples are presented in this document.

The package consists of the function blocks „LinMotFBAbsoluteMove“, „LinMotFBADSReadRAMParameter“, „LinMotFBADSRWriteRAMParameter“, the data structure „LinMotCom“, a little program in „Main“, a visualisation for controlling and the hardware configuration.

The function block „LinMotFBAbsoluteMove“ has the following functionality:

- Move to any position with definable maximal velocity, acceleration and deceleration.
- Automatic homing
- Error acknowledge
- QuickStop

The other two function blocks provide read and write functionality for RAM parameters of the controller.

All function blocks are multi instance capable.

Used software:	BECKHOFF TwinCAT	v2.11.1544 (Build 1544)
	PLC Control	v2.11.0 (Build 1016)
	System Manager	v2.11.0 (Build 1551)

The available documentation and project is made available free of charge from LinMot.
The software is to be understood as an example program.

Hardware configuration

TwinCAT System Manager

First of all the device description file has to be copied to the installation folder of TwinCAT. The needed XML file is located in the following folder by default:

C:\Program Files\LinMot\LinTalk1100 X.X Build XXXXXXXXX\Interfaces\EtherCAT\XML\

Copy the XML file to:

C:\TwinCAT\Io\EtherCAT\

If this is done the PLC should recognize all LinMot Servo controller on the EtherCAT fieldbus automatically. More details can be found in the user manual "EtherCAT interface".

Links to PLC Control

The inputs and outputs of the controller have to be linked as shown in Figure 1. The linked variables are defined in the global variables section "Drive A Bus Communication" of the PLC program.













Name	>Verknüpft mit
 DemandCurrent	DriveA_ComActualCurrent . Eingänge . Standard . LinMot_FB_AbsMove_EtherCAT_Para_v0.6
 ActualPosition	DriveA_ComActualPosition . Eingänge . Standard . LinMot_FB_AbsMove_EtherCAT_Para_v0.6
 StateVar	DriveA_StateVar . Eingänge . Standard . LinMot_FB_AbsMove_EtherCAT_Para_v0.6
 StatusWord	DriveA_StatusWord . Eingänge . Standard . LinMot_FB_AbsMove_EtherCAT_Para_v0.6
 Control Word	DriveA_ControlWord . Ausgänge . Standard . LinMot_FB_AbsMove_EtherCAT_Para_v0.6
 Motion Command Header	DriveA_MCHeader . Ausgänge . Standard . LinMot_FB_AbsMove_EtherCAT_Para_v0.6
 Motion Command Par 1	DriveA_MCParaWord0, DriveA_MCParaWord1
 Motion Command Par 2	DriveA_MCParaWord2, DriveA_MCParaWord3
 Motion Command Par 3	DriveA_MCParaWord4, DriveA_MCParaWord5
 Motion Command Par 4	DriveA_MCParaWord6, DriveA_MCParaWord7
 Motion Command Par 5	DriveA_MCParaWord8 . Ausgänge . Standard . LinMot_FB_AbsMove_EtherCAT_Para_v0.6
 AoENetId	DriveA_NetIDArray . Eingänge . Standard . LinMot_FB_AbsMove_EtherCAT_Para_v0.6

Figure 1: Input and output links

Configuration of the LinMot controller

The LinMot controller is configured with LinMot-Talk1100. Download from www.linmot.com

It is supposed that the motor attached to the controller is already configured with the motor wizard.

In order that the function block is able to activate a QuickStop in the "Control Word Parameter Force Mask" the "/QuickStop" (UPID 13EEh) has to be set to "False".

Note:

In case of doubt reset the controller to default values and afterwards configure the motor with the motor wizard. Previously save your actual configuration!

Set controller to default values:

- Switch off controller (24V).
- Set both rotary hex switches (S1 and S2) to F.
- Switch on controller (24V). The ERROR and WARN led are blinking alternately.
- Set both rotary hex switches (S1 and S2) to 0.
- Wait until EN and WARN led blink together.
- Switch off and on controller.

Interface

The TwinCAT project consists of the following components.

PLC Control:

LinMotFBAbsoluteMove	Function block to control and monitor the LinMot drive.
LinMotFBADSReadRAMParameter	Function block to read parameters of the controller
LinMotFBADSWriteRAMParameter	Function block to write parameters of the controller
LinMotCom	Data type (Structure). Contains all required variables for the communication between the function block and the drive. Saves inputs and outputs of the function block.
Main	Contains the call of an instance of LinMotFBAbsoluteMove and a little program.

System Manager:	Hardware configuration
-----------------	------------------------

LinMotCom

```

0001 TYPE LinMotCom :
0002 STRUCT
0003     (* Outputs *)
0004     ControlWord          :WORD;
0005     MCHheader            :WORD;
0006     MCParaWord0          :WORD;
0007     MCParaWord1          :WORD;
0008     MCParaWord2          :WORD;
0009     MCParaWord3          :WORD;
0010     MCParaWord4          :WORD;
0011     MCParaWord5          :WORD;
0012     MCParaWord6          :WORD;
0013     MCParaWord7          :WORD;
0014     MCParaWord8          :WORD;
0015
0016     (* Inputs *)
0017     StatusWord           :WORD;
0018     StateVar              :WORD;
0019     ComActualPosition     :DWORD;
0020     ComActualCurrent      :DWORD;
0021 END_STRUCT
0022 END_TYPE

```

Figure 2: Data type LinMotCom

LinMotFBAbsoluteMove

With the inputs and outputs of LinMotFBAbsoluteMove (Figure 3) the LinMot drive is controlled and monitored. On the next page they are described in Table 1 and Table 2. The function block is written in Structured Text (ST).

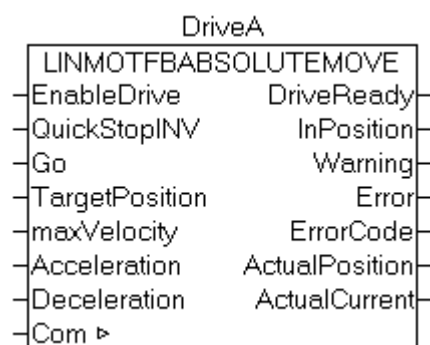


Figure 3: Inputs and outputs of LinMotFBAbsoluteMove

Inputs			
Name	Data type	Range	Description
Com	LinMotCom		LinMotCom is a data structure which contains all required variables for the communication between the PLC and the LinMot controller.
EnableDrive	Bool		Enables the drive. Is the motor not homed yet the homing is performed and afterwards switched to run mode, which is signalled with "TRUE" at output "DriveReady". Is the motor already homed it goes directly to run mode. An other function of this input is the error acknowledge. Is the input set low (False) an occurred error is acknowledged.
QuickStopINV	Bool		This inverted input activates a QuickStop if it goes low. As soon as the QuickStop is activated the motor is decelerated and stopped. To go back to run mode this input has to be set again and the EnableDrive input has to be switched off and on again. After QuickStop the motor is current less.
Go	Bool		On a rising edge a motion with the following parameters is executed.
Position	Real	+/- 214748	Target position in mm
Velocity	Real	0...2147	Maximal velocity in m/s
Acceleration	Real	0...21474	Acceleration in m/s^2
Deceleration	Real	0...21474	Deceleration in m/s^2

Table 1: Inputs of LinMotFBAbsoluteMove

Outputs		
Name	Data type	Description
DriveReady	Bool	Shows if drive is ready to operate.
InPosition	Bool	Is set if the motor is in target position. It is only set if the motor is at the position that has been set with the last evaluated command.
Warning	Bool	Active if warning is pending.
Error	Bool	Active if error is pending
ErrorCode	Byte	Error code of a pending error. (See manual „Motion Control SW“).
ActualPosition	Real	Actual position in mm
ActualCurrent	Real	Actual current in A (Ampère)

Table 2: Outputs of LinMotFBAbsoluteMove

States of LinMotFBAbsoluteMove

Figure 4 shows the different states of the function block. If the controller is started/restarted the function block is in state "Switch On Disabled". If the input "EnableDrive" is set it changes to state "Ready To Switch On". Thereby the "QuickStopINV" input has to be set to high! Is the motor already homed, this is the case for example after an error acknowledge, it directly goes to operating state "Operation enabled". Otherwise the homing procedure is done.

If the "QuickStopINV" input goes low a QuickStop is immediately activated. The motor is decelerated and as soon as it has stopped the motor becomes current less (Attention in case of vertical applications).

To go back to "Operation Enabled" after a QuickStop has been executed "EnableDrive" has to be set to 0 and "QuickStopINV" to 1. After that "EnableDrive" can be set back to 1 again.

If an error occurs it changes to state "Error". The error is acknowledged by setting the "EnableDrive" input to 0. After the error output goes low the "EnableDrive" can be set to 1 to go back to "Operation Enabled".

Attention: If the "EnableDrive" input is low the motor is current less!

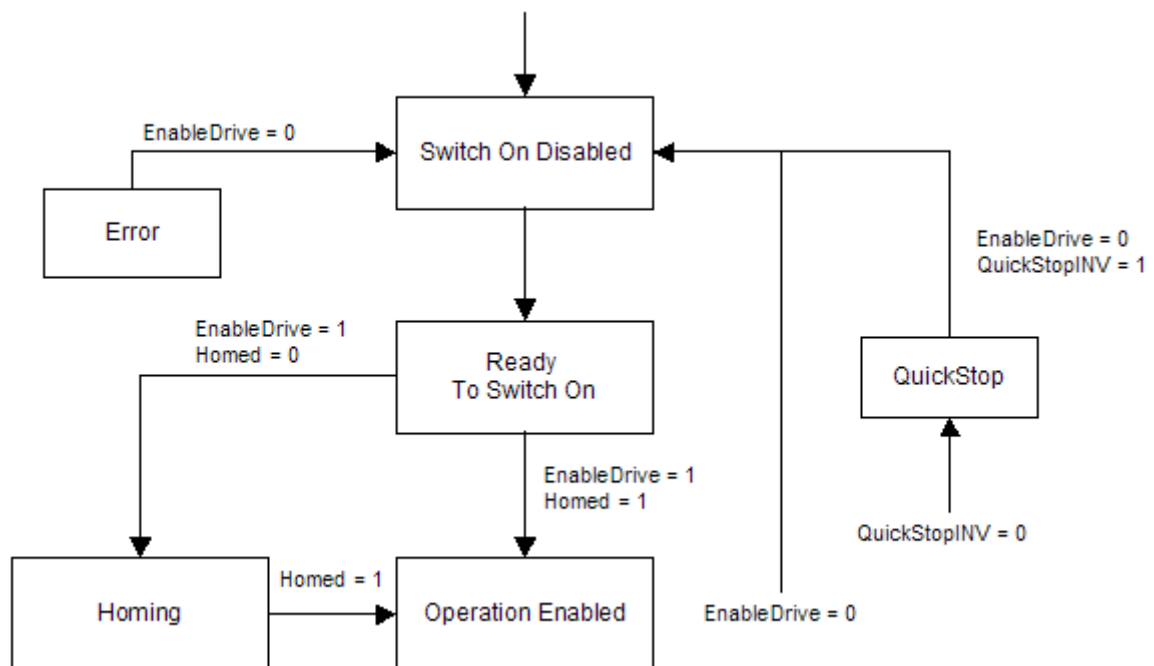


Figure 4: States of LinMotFBAbsoluteMove

Test program

In Main there is implemented a little example and the call of the function blocks.

It can be controlled with the visualisation included in the PLC program.

One can move to any target position with definable maximal velocity, acceleration and deceleration.

Start motion with GO button.

With the button “Start Cycle” set the motor moves cyclically between the four configurable positions.

Additionally the visualisation provides control of the parameter access function blocks.

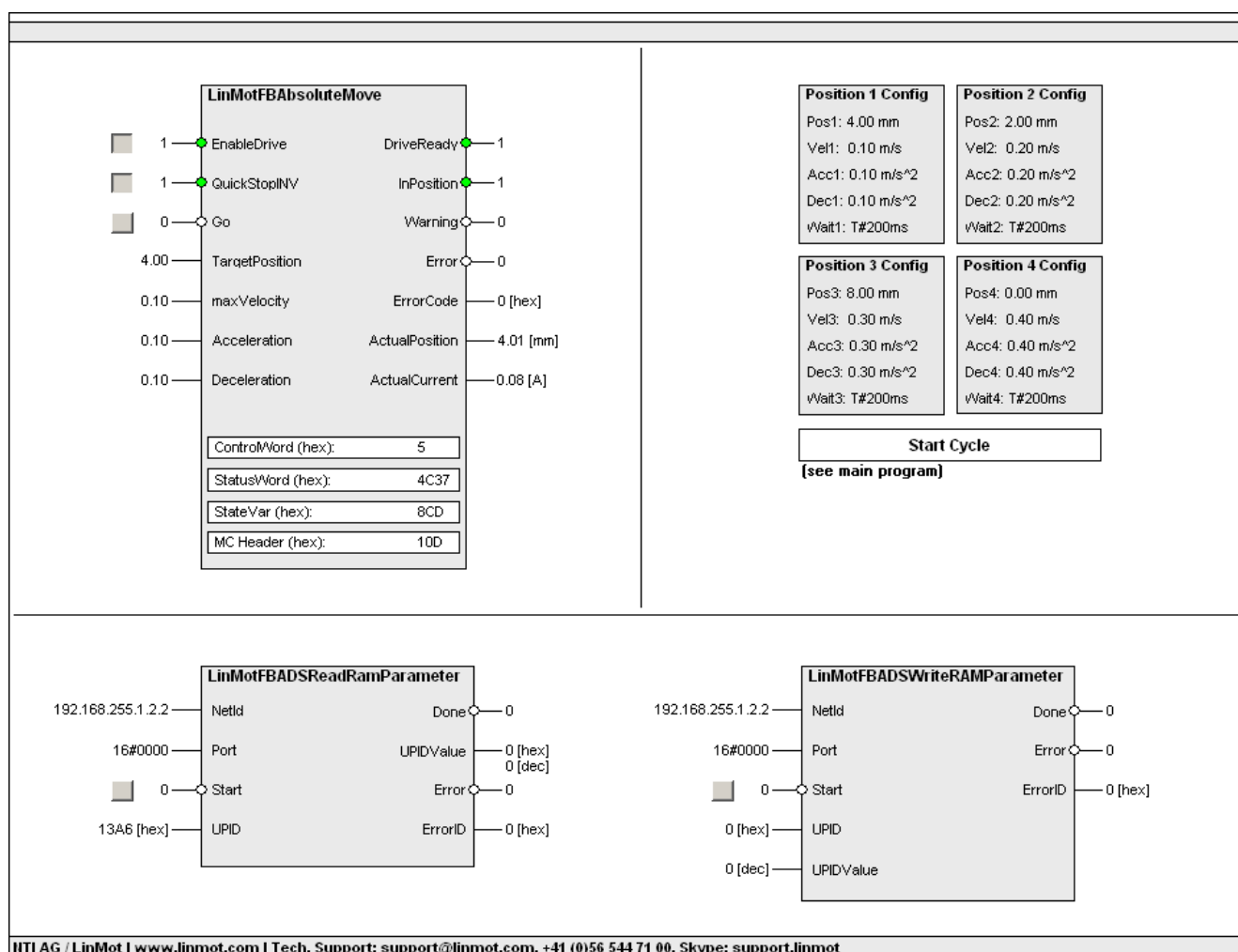


Figure 5: Visualisation

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