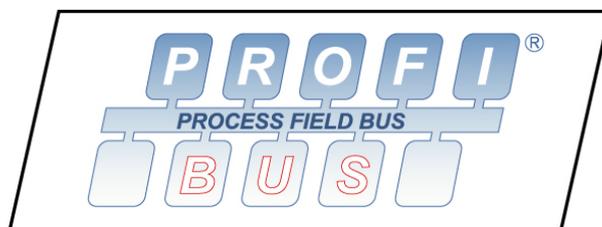

LinMot[®]



**Documentation of the PROFIBUS Interface of the following
Controllers:**

- E1130-DP (-HC, XC)



PROFIBUS Interface 3.9

User Manual

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Note

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Document version 3.9 / FM, August 2008

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1. System overview

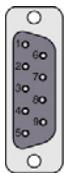
The LinMot PROFIBUS controllers E1130-DP are PROFIBUS-DP slaves.
 Further information on PROFIBUS can be found under: <http://www.profibus.com>

All baud rates are supported and automatically detected.

2. Connecting to the PROFIBUS

Pin Assignment of the DP Connector X9:

The PROFIBUS connector is a standard DSBU 9 female with the following pin assignment:



Pin 1	not connected	Pin 6	VP (+5VDC for bus termination)
Pin 2	not connected	Pin 7	not connected
Pin 3	B	Pin 8	A
Pin 4	CNTR-P	Pin 9	not connected
Pin 5	GND		

3. PROFIBUS Parameters

The PROFIBUS Servo Controllers have an additional parameter tree branch, which can be configured with the distributed LinMot Talk 1100 software. With these parameters, the PROFIBUS behaviour can be configured. The software LinMot Talk 1100 can be downloaded from <http://www.linmot.com> under the section download, software & manuals.

Dis-/Enable

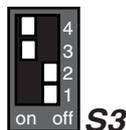
With the dis-/enable parameter the LinMot servo controller can be run without the PROFIBUS going online. So in first step the system can be configured and run without any bus connection.

PROFIBUS Interface \ Dis-/Enable	
Disable	Servo controller runs without PROFIBUS.
Enable	Servo controller runs only with a PROFIBUS connection.



IMPORTANT: To activate the PROFIBUS Interface, the Dip-Switch S3.4 "Interface" at the bottom of the drive has to be set to "ON"

S3
 ON – OFF
 Interface
 CAN Term
 RS485 Term
 RS485/232



Node Address

This directory contains the parameters defining the node address.

Node Address Selection

The node address parameter defines the source of the node address.

PROFIBUS Interface \ Node Address \ Node Address Selection	
By Hex Switches	The node address is determined by the two Hex Switches S1 (ID High) and S2 (ID Low) Attention, the ID defined by S1 and S2 is hexadecimal coded and not decimal!
By Parameter	The node address is determined by parameter setting

On default the node address is set by the rotary switches S1 and S2.



IMPORTANT: The rotary switches are hexadecimal. According to the PROFIBUS standard the maximal node address is **127** (addresses 126 and 127 are reserved for special purpose and should normally not be used).

Node Address Parameter Value

Defines the node address when "By Parameter" is selected.

Byte Order

Defines the used byte order.

PROFIBUS Interface \ Byte/Word Order \ Byte Order	
Reversed	Byte order is reversed. For S7 PLC's select reversed.
Not reversed	Byte order is not reversed.

Word Order

Defines the used word order.

PROFIBUS Interface \ Byte/Word Order \ Word Order	
Reversed	Word order is reversed. For S7 PLC's select reversed.
Not reversed	Word order is not reversed.

MC CMD Intf Par Order Defines the used parameter word order.

PROFIBUS Interface \ Byte/Word Order \ MC CMD Intf Par Order	
Reversed	Order is reversed. CMD Header - Par word 1 - Par word 0 - Par word 3 - Par word 2 - etc...
Not reversed	Order is not reversed. CMD Header - Par word 0 - Par word 1 - Par word 2 - Par word 3 - etc...

Diagnose Priority

Defines the behaviour of the diagnostic telegram.

PROFIBUS Interface \ Diagnose Priority	
None	Only minimal diagnostic data is transmitted.
Low	The diagnostic data is sent as status information only.
High	The diagnostic data is sent high priority in the error state.

Monitoring Channels Defines the source variable by UPID of the four monitoring channels.

PROFIBUS Interface\ Monitoring Channels	
Channel 1 UPID	Source for Monitoring Channel 1
Channel 2 UPID	Source for Monitoring Channel 2
Channel 3 UPID	Source for Monitoring Channel 3
Channel 4 UPID	Source for Monitoring Channel 4

4. PROFIBUS Variables

In the Variables directory of LinMot Talk there is a section \PROFIBUS which contains some information of the actual state of the PROFIBUS interface:

- **Node Address:**

This shows the used node address, which can be either configured by the two rotary hex-switches S1/S2 or by parameter settings, as a decimal number.
- **Baud Rate:**

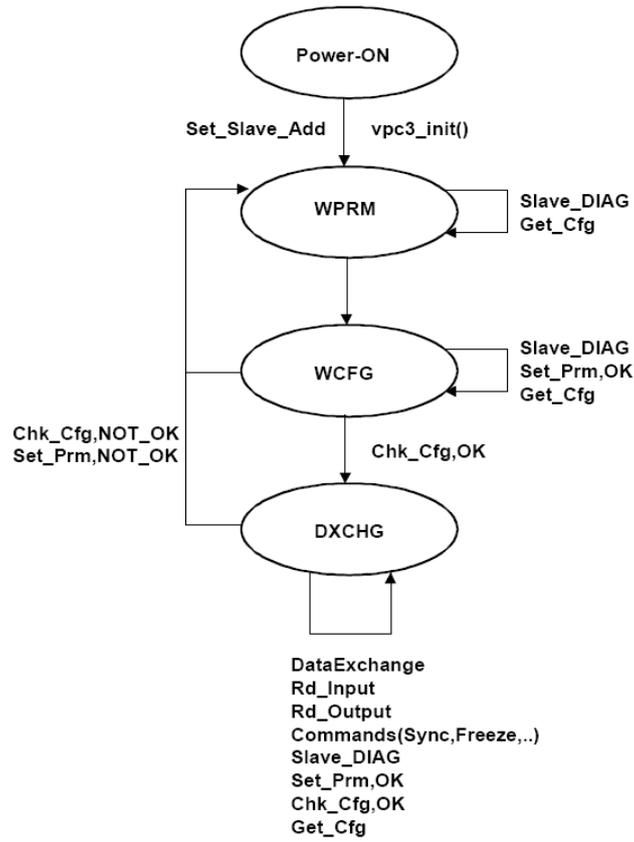
The baud rate is auto detect. This shows the baud rate, which was found on the bus. Zero means no baud rate found.
- **Bus Cycle Time fast:**

This shows the actual cycle time in μ s. The fast Cycle time is updated up to 10ms.
- **Bus Cycle Time slow:**

This shows the actual cycle time in ms. This value can be used when the bus cycle time is extremely large (>10ms).
- **DP State:**

This shows the actual state of the LinMot internal DP-State machine:

 - (0) Initialise: The firmware is initialising the PROFIBUS Interface
 - (1) Searching Baud rate: The detection of the baud rate is in progress.
 - (2) Wait for Parameter Telegram: No valid parameter telegram was yet received.
 - (3) Wait for Configuration Telegram: No valid configuration telegram was yet received.
 - (4) Ready for DataExchange: The PROFIBUS is ready for DataExchange, but the master has not done the transition.
 - (5) DataExchange: The PROFIBUS is running and exchanging cyclic data with the master.



5. PROFIBUS Modules

The LinMot Controller is a PROFIBUS-DP slave. To configure it with a PROFIBUS master, the GSD file is used. You can find the GSD file LINM092D.GSD in the LinMot-Talk1100 installation directory (typically C:\Program Files\LinMot\LinTalk1100 3.x\Firmware\Profibus\GSD).

There are the following modules defined, to be configured according the demands of the desired application:

Control/Status [1 Word DI/DO]

This module should always be configured. It consists of the Control and Status word, which are described in the document "User Manual Motion Control Software".

MC Cmd Interface [10 Word DO]

This maps the MC Command interface of the controller. Please refer to the documentation of the MC software.



Attention: Older Siemens S7 CPU firmware cannot directly write more than 4 byte consistent.

In this case the data has to be sent by SFC15 (please refer to the corresponding Siemens documentation)

Get MC Header Echo [1 Word DI]

This echoes the Cmd Header of the MC Command interface of the controller. Please refer to the documentation of the MC software.

Get Actual Position [2 Word DI]

The actual position of the configured motor. It's a 32 Bit integer with a resolution of 0.1µm .

Get Demand Position [2 Word DI]

The demand position of the configured motor. It's a 32 Bit integer with a resolution of 0.1µm.

Get Current [1 Word DI]

The set current of the configured motor. It's a 16 Bit integer with a resolution of 1mA .

Get StateVar [1 Word DI]

Consists of MainState and SubState. Please refer to the table "State Var" on chapter 3 of the "User Manual Motion Control Software".

The StateVar has all relevant flags and information for clean handshaking within one word and can therefore replace the modules "Get MC Header Echo" and "Get Error Code".

It's strongly recommended to use this module for handshaking.

Get WarnWord [1 Word DI]

1 Word Warnings. Please refer to chapter 9.

Get ErrorCode [1 Word DI]

1 Word ErrorCode. Please refer to chapter 8.

Monitoring Channel X [2 Word DI]

Transmits cyclic the value of the variable, which is defined by the Monitoring Channel Parameter (see chapter 3).

Parameter Channel [4 Word DI/DO]

The Parameter Channel module allows access to parameters, curves, error log and command table. Also restart, start and stop of the controller is possible. Of course the Parameter Channel module works independently from the MC Cmd Interface. For this reason changing a parameter and sending a motion command can be done in parallel.

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Argument (meaning depends on Cmd ID)	Argument (meaning depends on Cmd ID)
3.	Argument (meaning depends on Cmd ID)	Argument (meaning depends on Cmd ID)
4.	Argument (meaning depends on Cmd ID)	Argument (meaning depends on Cmd ID)

Parameter Channel Control

Parameter Command ID to Execute								Reserved				Command Count			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The Parameter Channel Control is split in two parts:

- Parameter Command ID to execute (Bit 8-15), see table Command ID
- Command Count (Bit 0-3)

Parameter Channel Status

Parameter Command Status								Reserved				Command Count Resp.			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The Parameter Channel Status is split in two parts:

- Parameter Status (Bit 8-15), see table Parameter Status
- Command Count Response (Bit 0-3)

Command Count

A new command is only evaluated, if the value of the command count changes. In the easiest way bit 0 could be toggled.

Parameter Command ID

This selects the command.

Possible Commands are:

Command ID	Description
00h	No Operation
Parameter Access	
10h	Read ROM Value of Parameter by UPID
11h	Read RAM Value of Parameter by UPID
12h	Write ROM Value of Parameter by UPID
13h	Write RAM Value of Parameter by UPID
14h	Write RAM and ROM Value of Parameter by UPID
15h	Get minimal Value of Parameter by UPID
16h	Get maximal Value of Parameter by UPID
17h	Get default Value of Parameter by UPID

Parameter (UPID) List	
20h	Start Getting UPID List
21h	Get next UPID List item
22h	Start Getting Modified UPID List
23h	Get next Modified UPID List item
Stop / Start / Default	
30h	Restart Controller
31h	Set ROM to default (OS)
32h	Set ROM to default (MC SW)
33h	Set ROM to default (Interface)
34h	Set ROM to default (Application)
35h	Stop MC and Application Software (for Flash access)
36h	Start MC and Application Software
Curve Service	
41h	Curve Service: Delete all Curves (RAM)
50h	Curve Service: Add Curve
51h	Curve Service: Add Curve Info Block
52h	Curve Service: Add Curve Data
53h	Curve Service: Modify Curve
54h	Curve Service: Modify Curve Info Block
55h	Curve Service: Modify Curve Data
60h	Curve Service: Get Curve
61h	Curve Service: Get Curve Info Block
62h	Curve Service: Get Curve Data
Error Log	
70h	Get Error Log Entry Counter
71h	Get Error Log Entry Error Code
72h	Get Error Log Entry Time low
73h	Get Error Log Entry Time high
74h	Get Error Code Text Stringlet
Command Table	
80h	Command Table: Save to Flash
81h	Command Table: Delete all Entries (RAM)
82h	Command Table: Delete Entry (Entry Number)
83h	Command Table: Write Entry
84h	Command Table: Write Entry Data
85h	Command Table: Get Entry (Entry Number)
86h	Command Table: Get Entry Data
87h	Command Table: Get Entry List (Entry 0..31)
88h	Command Table: Get Entry List (Entry 32..63)
89h	Command Table: Get Entry List (Entry 64..95)
8Ah	Command Table: Get Entry List (Entry 96..127)
8Bh	Command Table: Get Entry List (Entry 128..159)
8Ch	Command Table: Get Entry List (Entry 160..191)
8Dh	Command Table: Get Entry List (Entry 192..223)
8Eh	Command Table: Get Entry List (Entry 224..255)

Parameter Status	Description
00h	OK, done
02h	Command Running / Busy
04h	Block not finished (Curve Service)
05h	Busy
C0h	UPID Error
C1h	Parameter Type Error
C2h	Range Error
C3h	Address Usage Error
C5h	Error: "Get next UPID List item" was executed without prior execution of "Start getting UPID List"
C6h	End of UPID List reached (no next UPID List item found)
D0h	Odd Address
D1h	Size Error (Curve Service)
D4h	Curve already defined / Curve not present (Curve Service)

Overview Parameter access:

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Parameter UPID	Parameter UPID
3.	Parameter Value Low	Parameter Value Low
4.	Parameter Value High	Parameter Value High

Overview Curve access:

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Curve Number	Curve Number
3.	Data Value Low / Info Block size	Data Value Low / Info Block size
4.	Data Value High / Data Block size	Data Value High / Data Block size

Start getting UPID List:

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Start UPID (search from this UPID)	-
3.	-	-
4.	-	-

Get next UPID List item:

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	-	UPID found
3.	-	Address Usage
4.	-	-

Address Usage:

			Not used for Hash calculation						Life Parameter								ROM Write	ROM Read	RAM Write	RAM Read
15	14	13		11	10	9	8	7		6	5	4	3	2	1	0				

Start getting Modified UPID List:

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Start UPID (search from this UPID)	-
3.	-	-
4.	-	-

Get next Modified UPID List item:

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	-	UPID found
3.	-	Data Value Low
4.	-	Data Value High

Get Error Log Entry Counter:

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	-	-
3.	-	Number of Logged Errors
4.	-	Number of Occurred Errors

Get Error Log Entry Error Code:

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Entry Number (0..20)	Entry Number
3.	-	Logged Error Code
4.	-	-

Get Error Log Entry Time Low:

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Entry Number (0..20)	Entry Number
3.	-	Entry Time Low Word
4.	-	Entry Time Mid Low Word

Get Error Log Entry Time High:

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Entry Number (0..20)	Entry Number
3.	-	Entry Time Mid High Word
4.	-	Entry Time High Word

The Error Log Entry Time consists of 32Bit hours (Time High) and 32Bit ms (Time Low).

Get Error Code Text Stringlet:

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Error Code	Error code
3.	Stringlet Number (0..7)	Stringlet Byte 0 and 1
4.	-	Stringlet Byte 2 and 3

Command Table: Save to Flash

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	-	-
3.	-	-
4.	-	-

The MC software should be stopped (with command "35h: Stop MC and Application Software").

The PROFIBUS Interface will stay active while the MC software is stopped.

Command Table: Delete All Entries (RAM)

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	-	-
3.	-	-
4.	-	-

Command Table: Delete Entry

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Entry Number	Entry Number
3.	-	-
4.	-	-

Command Table: Write Entry

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Entry Number	Entry Number
3.	Block Size (even number of bytes)	Block Size
4.	-	-

Command Table: Write Entry Data

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Entry Number	Entry Number
3.	Data	Data
4.	Data	Data

Command Table: Get Entry

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Entry Number	Entry Number
3.	-	Block Size
4.	-	-

Command Table: Get Entry Data

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	Entry Number	Entry Number
3.	-	Data
4.	-	Data

Command Table: Get Entry List (0..7)

Word	DO	DI
1.	Parameter Channel Control	Parameter Channel Status
2.	-	Offset in bytes
3.	-	Bit field (Bit set= undefined / Bit cleared = used)
4.	-	Bit field (Bit set= undefined / Bit cleared = used)



Further documentation on how to configure a controller by fieldbus and handle curves can be found on the additional manual "Parameterization of LinMot E1100 Servo Controllers over Fieldbus Interfaces".



With STEP7 from Siemens the module "Universal Module" must never be configured.

6. State Machine

Please refer to “User Manual Motion Control Software”

7. PROFIBUS Diagnosis

The LinMot controller supports 12 byte of diagnostic data. The diagnosis telegram is according the following table:

Byte	Description
0..5	Data according PROFIBUS-DP standard
6..7	Extended Diagnosis Header and stuffing
8..9	Warn Word (see chapter 9 for description)
10..11	Error Code (see chapter 8 for description)

8. Error Codes

Please refer to “User Manual Motion Control Software” for the Error Codes of the MC Software. The PROFIBUS Interface has the following additional Error Codes:

Error Code Hexadecimal	Error Description
\$C1	Fatal Error: Controller not supported
\$C2	Config Error: Invalid MACID
\$C3	DP Err: Connection lost

9. Warn Word

Please refer to “User Manual Motion Control Software”

10. Example for Siemens Simatic S7

The following example shows the homing procedure, the execution of a motion command and the change of a parameter together with S7 and Simatic from Siemens:

Bus configuration (HW Config)

The screenshot shows the 'HW Config' software interface for a SIMATIC 300(1) station. The hardware rack configuration is as follows:

Slot	Component
1	CPU 313C-2 DP
X2	DP
2.2	DI16/DO16
2.4	Zählen
3	
4	

The bus configuration is labeled 'PROFIBUS(1): DP-Mastersystem (1)'. A LinMot E1130-DP device is connected to the bus.

The detailed configuration for the LinMot E1130-DP device is shown in the table below:

Slot	DP ID	Order Number / Designation	I Address	Q Address
1	193	Control/Status [1 Word DI/DO]	10...11	10...11
2	129	MC Cmd Interface [10 Word DO]		20...39
3	65	Get StateVar [1 Word DI]	20...21	
4	65	Get Actual Position [2 Word DI]	22...25	
5	65	Get Current [1 Word DI]	26...27	

Homing procedure

1. Release lock state: Control Word = 0x0000h (Only needed if StateVar MainState is 00h) :

	Address	Symbol	Display format	Status value	Modify value
1	W 10		HEX	W#16#8834	
2	QW 10		HEX	W#16#0000	W#16#0000

StateVar MainState becomes 02h: Ready to Switch On

	Address	Symbol	Display format	Status value	Modify value
1	W 20		HEX	W#16#0200	

2. Homing: Control Word = 0x083Fh

	Address	Symbol	Display format	Status value	Modify value
1	W 10		HEX	W#16#4C37	
2	QW 10		HEX	W#16#083F	W#16#083F

StateVar MainState becomes 09h: Homing, Homing is finished if SubState becomes 0Fh

	Address	Symbol	Display format	Status value	Modify value
1	W 20		HEX	W#16#090F	

3. Enter Operational State: Control Word = 0x003Fh

	Address	Symbol	Display format	Status value	Modify value
1	W 10		HEX	W#16#4C37	
2	QW 10		HEX	W#16#003F	W#16#003F

StateVar MainState becomes 08h: Operation Enabled, Drive is ready for motion commands

	Address	Symbol	Display format	Status value	Modify value
1	W 20		HEX	W#16#08C0	

Execute Motion Command: VAI Go To Pos (010xh)

Name	Description	Scaled Value	Int. Value (HEX)
Header	VAI Go To Pos (010xh)	257	
0101h			
1. Par	Target Position:	50mm	0007A120h
2. Par	Maximal Velocity:	1m/s	000F4240h
3. Par	Acceleration:	10m/s ²	000F4240h
4. Par	Deceleration:	10m/s ²	000F4240h

In the case of \Parameters\PROFIBUS Interface\Byte/Word Order\MC CMD Intf Par Order\not reversed (default setting):

	Address	Symbol	Display format	Status value	Modify value
1	QW 20		HEX	W#16#0101	W#16#0101
2	QW 22		HEX	W#16#A120	W#16#A120
3	QW 24		HEX	W#16#0007	W#16#0007
4	QW 26		HEX	W#16#4240	W#16#4240
5	QW 28		HEX	W#16#000F	W#16#000F
6	QW 30		HEX	W#16#4240	W#16#4240
7	QW 32		HEX	W#16#000F	W#16#000F
8	QW 34		HEX	W#16#4240	W#16#4240
9	QW 36		HEX	W#16#000F	W#16#000F
10	QW 38		HEX	W#16#0000	

In the case of \Parameters\PROFIBUS Interface\Byte/Word Order\MC CMD Intf Par Order\reversed:

	Address	Symbol	Display format	Status value	Modify value
1	QW 20		HEX	W#16#0101	W#16#0101
2	QW 22		HEX	W#16#0007	W#16#0007
3	QW 24		HEX	W#16#A120	W#16#A120
4	QW 26		HEX	W#16#000F	W#16#000F
5	QW 28		HEX	W#16#4240	W#16#4240
6	QW 30		HEX	W#16#000F	W#16#000F
7	QW 32		HEX	W#16#4240	W#16#4240
8	QW 34		HEX	W#16#000F	W#16#000F
9	QW 36		HEX	W#16#4240	W#16#4240
10	QW 38		HEX	W#16#0000	

To send the next command the count nibble has to be changed. The header for the next VAI Go To Pos command is therefore 0100h.

As it appears with LinMot-Talk1100 after "Read Command" in the Control Panel:

Motion Command Interface

Enable Manual Override:

Command Category: Most Commonly Used ▼

Command Type: VAl Go To Pos (010xh) ▼

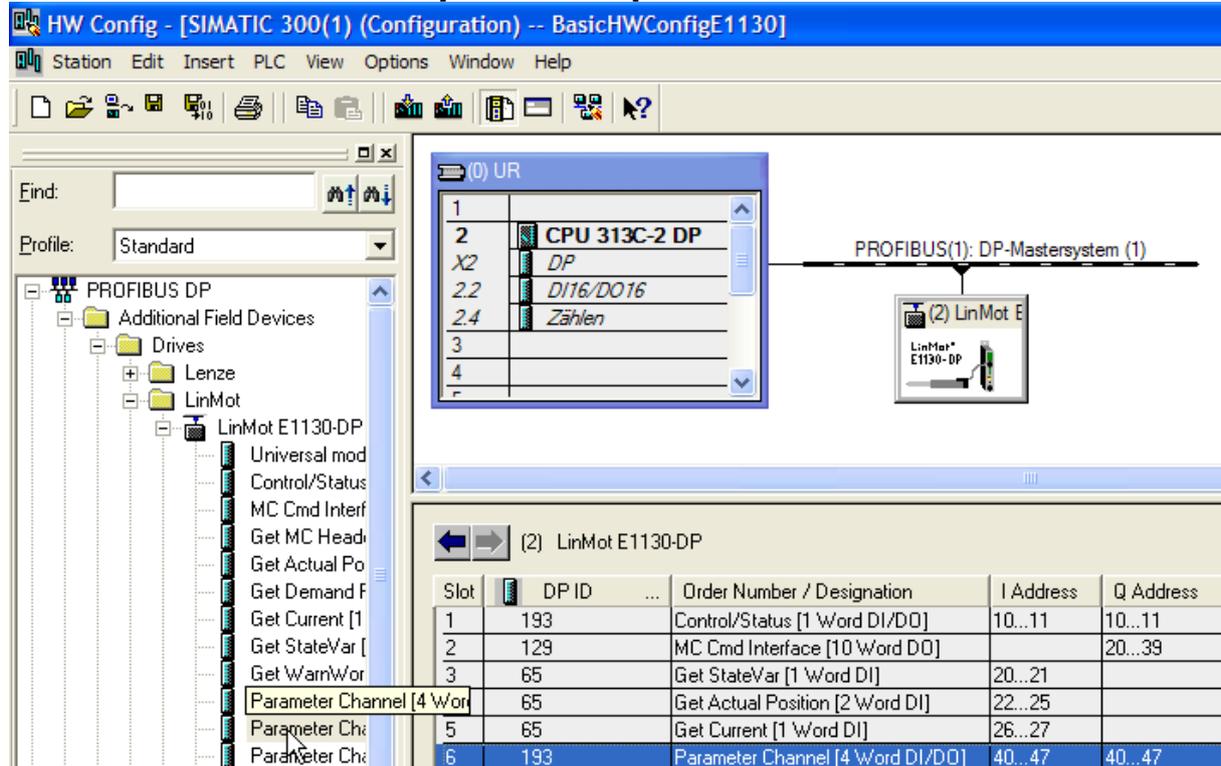
Count Nibble (Toggle Bits): 1h ▼ Auto Increment Count Nibble

Name	Offs.	Description	Scaled Value	Int. Value (Dec)	Int. Value (Hex)
Header	0	010xh: VAl Go To Pos	257	257	0101h
1. Par	2	Target Position	50 mm	500000	0007A120h
2. Par	6	Maximal Velocity	1 m/s	1000000	000F4240h
3. Par	10	Acceleration	10 m/s ²	1000000	000F4240h
4. Par	14	Deceleration	10 m/s ²	1000000	000F4240h

Change a parameter of the controller with the Parameter Channel Module

Example task: Change the “Maximal Current” (UPID 13A6h) over Profibus while firmware is running

Add module Parameter Channel [4 Word DI/DO]



As Command ID use 13h “Write RAM Value of Parameter by UPID”, Command Count 1
 The UPID of “Maximal Current” is 13A6h. The internal scaling of the current value is 0.001A:
 3A (Scaled) = 3000 (Int) = 0000088Bh (HEX)

Word	Description	Value (Hex)
1.	Parameter Channel Control	1301h
2.	Parameter UPID	13A6h
3.	Parameter Value Low	088Bh
4.	Parameter Value High	0000h

Monitor/Modify - 193 - (R-/S6)

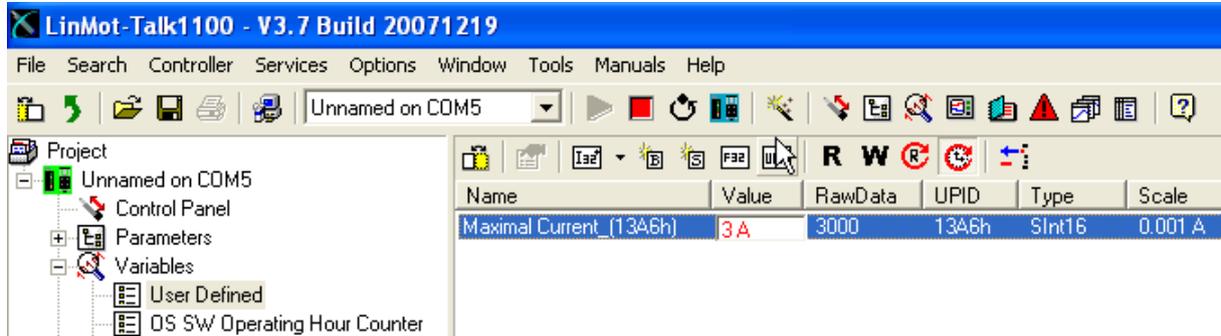
Online via assigned CPU services

Path: BasicHWConfigE1130\SIMATIC 300(1)\CPU 313C-2 DP

	Address	Symbol	Display format	Status value	Modify value
1	W 40		HEX	W#16#0001	
2	W 42		HEX	W#16#13A6	
3	W 44		HEX	W#16#088B	
4	W 46		HEX	W#16#0000	
5	QW 40		HEX	W#16#1301	W#16#1301
6	QW 42		HEX	W#16#13A6	W#16#13A6
7	QW 44		HEX	W#16#088B	W#16#088B
8	QW 46		HEX	W#16#0000	W#16#0000

Check if parameter has been changed with LinMot-Talk1100

Add a new User Defined variable by clicking on the button UPID and search for the UPID 13A6h

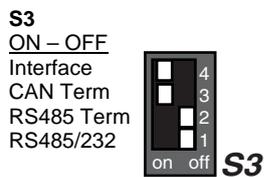


Hint: Consider the Command Count in the Parameter Channel Control. A new command is only evaluated, if the value of the command count changes. In the easiest way bit 0 could be toggled.

11. Troubleshooting

If the PROFIBUS connection is not working, proceed as followed:

- Is the correct firmware installed on the controller? When installing the firmware the PROFIBUS interface must be selected. The actual firmware and configuration software can always be downloaded from <http://www.linmot.com>
- Is the node address correct (attention, the rotary switches are hexadecimal)? The correct setting can be verified with LinMot Talk 1100 in the variables section under \PROFIBUS\Node Address
- The interface switch S3.4 must be ON



- When using a S7 PLC from Siemens, the “universal module” should never be configured.
- Check if the correct GSD file is used (LINM092D.GSD, which is provided together with LinMot Talk 1100 in the subdirectory. \firmware\PROFIBUS\GSD). Attention the Controller Series E430-DP and E4030-DP have a different and incompatible GSD file.
- Check bus cabling and termination.

12. Contact Addresses

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