LinMot®

Documentation of the LinUDP Interface of the following Drives:

- E1250-IP-UC
- E1400-IP-QN

LinUDP Interface

User Manual

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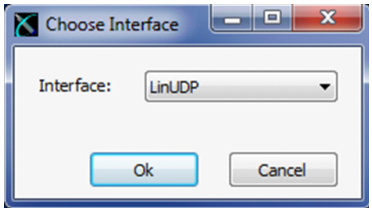
1 Overview

The LinUDP protocol is an easy way for communication with a LinMot servo drive over Ethernet. There are no checks done to make sure if the messages have reached their destination and if they are correctly received. When communicating via LinUDP, the drive has no active function, it only responds to requests with the appropriate answers.

2 Installation on Servo Drive

For installing the LinUDP firmware on the servo drive, start the LinMot- Talk software and press the install firmware button . Choose the file "Firmware_Buildxxxxxxxx.sct" and press "Open". The wizard will guide you through the installation. When asking for the interface software choose "LinUDP":

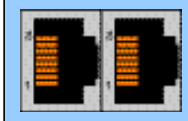


Press ok and follow the rest of the wizard.

3 Connecting LinUDP

3.1 Pin Assignment of the Connectors X17 - X18

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

X17 – X18	RealTime Ethernet Connector		
	**Pin**	**Wire color code**	**Assignment 100BASE-TX**
	1	WHT/ORG	Rx+
	2	ORG	Rx-
	3	WHT/GRN	Tx+
	4	BLU	-
	5	WHT/BLU	-
	6	GRN	Tx-
	7	WHT/BRN	-
	8	BRN	-
	case	-	-
RJ-45	Use standard patch cables (twisted pair, S/UTP, AWG26) for wiring. This type of cable is usually referred to as a "Cat5e-Cable".		

4 LinUDP Telegram

In LinUDP there are two telegrams used, one for the request from the master and the other one for the response from the drive. These two telegrams have the following layout:

Name	Size [Byte]
DHCP Header	14
IPv4 Header	20
LinUDP Header	8
LinUDP Data	message dependent

4.1 DHCP Header

The DHCP Header looks like in the following table.

	0. Byte	1. Byte	2. Byte	3. Byte	4. Byte	5. Byte	6. Byte	7. Byte
+0	Destination MAC ID							
+8	Source MAC ID					Protocol Typ (0x0800)		

4.2 IPv4 Header

The IPv4 header is described in the rfc0791 in chapter 3.1. Rfc0791 could be found on www.ietf.org/rfc/rfc0791.txt. The sections options and padding are not used.

4.3 LinUDP Header

The LinUDP header consists of four parts. They are showing ind the following table.

Name	Size [Byte]
Source Port	2
Destination Port	2
Length of UDP Telegram	2
UDP Checksum	2

The LinUDP ports are fix assigned. For the Master it is port 41136 and for the drive it is port 49360. In Hex-Code they are A0B0 and C0D0.

4.4 LinUDP Data

In LinUDP data are the data which we want to transfer. The construction of this data

part always is the same. The only difference are the source and destination, they are switched.

4.4.1 Request from the Master

The first 32 bits of the LinUDP data define the request and the following 32 bits define the format of the response. The following tables show how the request definition and the response definition look like.

Request definition

Bit	Name	Data size [Byte]
0	Control Word	2
1	MC Interface	32
2	Realtime Configuration	8
3 – 31	Reserved for future expansions	

Response definition

Bit	Name	Data size [Byte]
0	Status Word	2
1	State Var	2
2	Actual Position	4
3	Demand Position	4
4	Current	2
5	Warn Word	2
6	Error Code	2
7	Monitoring Channel	16
8 – 31	Reserved for future expansions	

Each of the definition bits shows if the corresponding parameter is part of the communication. The order of the requested data parts is the same as the definition bits. When a definition bit is not set, the data part would not be transferred. When all bits of the request definition are set, then the LinUDP data looks like it is shown in the following table. Each field represents one byte.

	0. Byte	1. Byte	2. Byte	3. Byte	4. Byte	5. Byte	6. Byte	7. Byte
+0	Request Definition				Response Definition			
+8	Control Word							
+16								
+24	MC Interface							
+32								
+40			Realtime Configuration					
+48								

4.4.2 Response from the Drive

The LinUDP data part of a response from a drive has the same construction like the data part of a request. The order of the response data part is the same as the response definition bits. The only exception is the last part of the response data part with the realtime configuration data. When all bits in the response definition are set then the response data part looks like in the following table.

	0. Byte	1. Byte	2. Byte	3. Byte	4. Byte	5. Byte	6. Byte	7. Byte
+0	Request Definition				Response Definition			
+8	Status Word		State Var		Actual Position			
+16	Demand Position				Current		Warn Word	
+24	Error Code		Monitoring Channel					
+32			Realtime Configuration					
+40								

5 LinUDP Parameters

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

The additional parameter tree branch is called “LinUDP Intf”. In this branch are the following Parameters.

- **Dis-/Enable**, with this Parameter the interface could be turned off and on.
- **Ethernet Configuration** is the part where the connection type could be chosen.

- **Monitoring Channels** defined 4 UPID. The values of this UPID are in the response data part when the monitoring channel bit is set active.

Monitoring Channels		
Channel 1 UPID	Source UPID for Monitoring Channel 1	Parameter UPID = 20A8
Channel 2 UPID	Source UPID for Monitoring Channel 2	Parameter UPID = 20A9
Channel 3 UPID	Source UPID for Monitoring Channel 3	Parameter UPID = 20AA
Channel 4 UPID	Source UPID for Monitoring Channel 4	Parameter UPID = 20AB

- **Master Configuration** is for the communication safety. With the radio buttons under single master there can chosen three possibilities.
  - **No Filter** means the drive does no control. This option is choose per default.
  - **Single Master** means the drive takes the IP Address from the sender of the first LinUDP telegram, which it receives and after that it only responses to telegrams with this address.
  - **Single Master with fix IP**: In the parameters called Master IP Address define a IP Address and the drive only responses to telegrams with this fix address.
- **Master IP Address** the fix IP address is defined in this parameters.

6 LinUDP Modules

In LinUDP there are three modules implemented for the master to drive communication and eight modules for the drive to master communication.

6.1 Master to drive Modules

Control Word

With the control word the main state machine of the drive can be accessed. Please refer to “User Manual Motion Control Software” for the control word.

MC Cmd Interface

This maps the MC command interface of the drive. Please refer to the documentation of the MC software.

Real Time Configuration

The real time configuration module allows accessing to parameters, variables, curves, error log and command table. Also restart, start and stop of the drive can be initiated. Of course the parameter channel module works independently from the MC command interface. For this reason, changing a parameter and sending a motion command can be done in parallel. The real time configuration has influence on both telegram directions. For details see chapter 6 Real Time Config.

6.2 Drive to master Modules

Status Word

The status word consists of 16 bits. Please refer to “User Manual Motion Control Software” for watch about the meaning of each bit the status word.

State Var

The State Var consists of MainState and SubState. Please refer to the table “State Var” on chapter 3 of the “User Manual Motion Control Software”. The State Var 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”.

Actual Position

Returns the actual position of the motor. (32 Bit integer value, resolution 0.1 µm)

Demand Position

Returns the demand position of the motor. (32 Bit integer value, resolution 0.1 µm)

Current

Returns the set current of the motor. (32 Bit integer value, resolution 1 mA)

Warn Word

Returns the warn word. Please refer to “User Manual Motion Control Software”.

Error Code

Returns the error code. Please refer to “User Manual Motion Control Software” for the Error Codes of the MC software.

Monitoring Channel

Transmits cyclically the value of the variable, which is defined by the monitoring channel Parameter (see chapter 3)

7 Real Time Config Module

The structure of the real time config is shown in the following table. DO stands for data output and DI for data input. The point of view for the definition of DO and DI is the Master.

Word number	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)

Real Time Config Control

Parameter Command ID to be executed								**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 be executed (bits 8-15), see table Command ID
- Command Count (bits 0-3)

Real Time Config Status

Parameter Status								**Reserved**				**Command Count Response**			
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 (bits 8-15), see table Parameter Status
- Command Count Response (bits 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 ROM 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 Drive
31h	Set parameter ROM values to default (OS SW)
32h	Set parameter ROM values to default (MC SW)
33h	Set parameter ROM values to default (Interface SW)
34h	Set parameter ROM values to default (Application SW)
35h	Stop MC and Application Software (for Flash access)
36h	Start MC and Application Software

Curve Service	
40h	Save all Curves from RAM to Flash
41h	Delete all Curves (RAM)
50h	Start Adding Curve (RAM)
51h	Add Curve Info Block (RAM)
52h	Add Curve Data (RAM)
53h	Start Modifying Curve (RAM)
54h	Modify Curve Info Block (RAM)
55h	Modify Curve Data (RAM)
60h	Start Getting Curve (RAM)
61h	Get Curve Info Block (RAM)
62h	Get Curve Data (RAM)
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
83h	Command Table: Write Entry
84h	Command Table: Write Entry Data
85h	Command Table: Get Entry
86h	Command Table: Get Entry Data
87h	Get Presence List of Entries 0..31 from RAM
88h	Get Presence List of Entries 32..63 from RAM
89h	Get Presence List of Entries 64..95 from RAM

8Ah	Get Presence List of Entries 96..127 from RAM
8Bh	Get Presence List of Entries 128..159 from RAM
8Ch	Get Presence List of Entries 160..191 from RAM
8Dh	Get Presence List of Entries 192..223 from RAM
8Eh	Get Presence List of Entries 224..255 from RAM

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: Command 21h “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 / Info 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:

			calculation Not used for Hash				Life Parameter					ROM Write	ROM Read	RAM Write	RAM Read
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Start getting Modified UPID List (Command ID 22h):

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 (Command ID 23h):

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 (Command ID 70h):

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 (Command ID 71h):

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 (Command ID 72h):

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 (Command ID 73h):

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 32 Bit hours (Time High) and 32 Bits ms (Time Low).

Get Error Code Text Stringlet (Command ID 74h):

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 (Command ID 75h):

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

For this command, the MC software must be stopped (with command “35h: Stop MC and Application Software”). The LinUDP Interface will stay active while the MC software is stopped.

Command Table: Delete All Entries (RAM) (Command ID 81h):

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

Command Table: Delete Entry (Command ID 82h):

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

Command Table: Write Entry (Command ID 83h):

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 (Command ID 84h):

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 (Command ID 85h):

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

Command Table: Get Entry Data (Command ID 86h):

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) (Command IDs 87h .. 8Eh):

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)

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