PROFINET

User Manual

LINAK®
WE IMPROVE YOUR LIFE

Contents

Preface

Dear User,

We are delighted that you have chosen a LINAK® product.

LINAK systems are high-tech products based on many years of experience in the manufacture and development of actuators, lifting columns, desk frames, electric control boxes, controls, batteries, accessories and chargers.

This User Manual does not address the end user. It is intended as a source of information for the equipment or system manufacturer only, and it will tell you how to install, use and maintain your LINAK electronics. The manufacturer of the end product has the responsibility to provide a User Manual, where relevant safety information from this manual is passed on to the end user.

We are convinced that your LINAK product/system will give you many years of problem-free operation.

Before our products leave the factory, they undergo both function and quality testing. Should you, nevertheless, experience problems with your product/system, you are always welcome to contact your supplier.

LINAK subsidiaries and some distributors situated all over the world have authorised service centres, which are always ready to help you. Locate your local contact information on the back page.

LINAK provides a warranty on all products. (See warranty section).

This warranty, however, is subject to correct use in accordance with the specifications, maintenance being done correctly, and any repairs being carried out at a service centre, which is authorised to repair LINAK products.

Changes in installation and use of LINAK systems can affect their operation and durability. The products may only be opened by authorised personnel.

This User Manual has been written based on the present technical knowledge. LINAK reserves the right to carry out technical modifications and keeps the associated information updated.

LINAK A/S

Terms of use

LINAK® takes great care in providing accurate and up-to-date information on its products. However, the user is responsible for determining the suitability of LINAK products for a specific application.

Due to continual development, LINAK products are subject to frequent modifications and changes. LINAK reserves the rights to conduct modifications, updates, and changes without any prior notice. For the same reason, LINAK cannot guarantee the correctness and actual status of imprinted information on its products.

LINAK uses its best efforts to fulfil orders. However, for the reasons mentioned above, LINAK cannot guarantee availability of any particular product at any given time. LINAK reserves the right to discontinue the sale of any product displayed on its website or listed in its catalogues or in other written material created and produced by LINAK, LINAK subsidiaries, or LINAK affiliates.

All sales are subject to the 'Standard Terms of Sale and Delivery for LINAK A/S' available on LINAK websites.

Revision overview

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LA14, LA25, and LA21 added	All over the document
Identical cells in tables merged	All over the document
'Read' and 'Write' changed to 'R' and 'W'	All over the document
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Edition B

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'Option 1 - A simple parallel setup' illustration updated	Page 9
'Command examples' section updated	Page 14-17
'Process data' section added	Page 18-23
Data records, Configuration and Diagnostics removed	

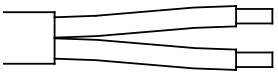
Edition A

New document

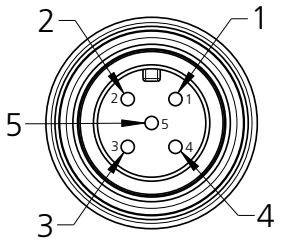
Connection diagram

Applicable for: LA14, LA25, LA21, LA33, LA36, LA37, LA73, LA76 and LA77

BROWN	24/48 V DC
BLUE	GND

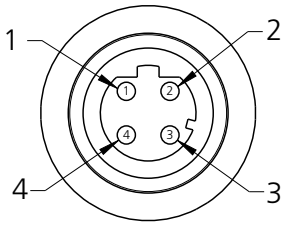


4	Split power supply V DC
1	Extends the actuator
2	Retracts the actuator
3	Parallel data +
5	Parallel data -



M12
A-Code male

1	ETH_TX+
2	ETH_RX+
3	ETH_TX-
4	ETH_RX-

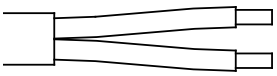


M12
D-Code female

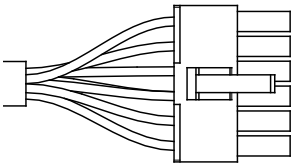
Connection diagram

Applicable for: LC3 IC

BROWN	24/48 V DC
BLUE	GND

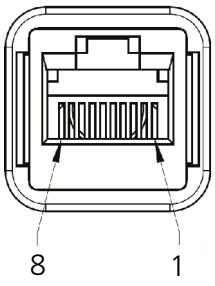


ORANGE	Split power supply V DC
RED	Extends the actuator
BLACK	Retracts the actuator
VIOLET	Parallel data +
WHITE	Parallel data -
YELLOW	Not to be connected
GREEN	Not to be connected
LIGHT BLUE	Not to be connected
GREY	Not to be connected



Molex mini-fit
12-pin

1	ETH_TX+
3	ETH_RX+
2	ETH_TX-
6	ETH_RX-



RJ45

I/O specifications

Input/Output		Specification	Comments
Description		The physical layer conforms to the IEEE 802.3-2018 standard with communication speeds of 10 Mbps and 100 Mbps, respectively. Cable length is reduced to = 100 m without repeater, as determined by IEEE 802.3-2018.	
Brown		Connect Brown to positive 24/48 V DC	Note: Do not change the power supply polarity on the Brown and Blue wires! Only for powering the motor driver module. Power supply GND is electrically connected to the housing through a capacitor and resistor in parallel.
Blue		Connect Blue to negative GND	
PIN out		**Data cable M12 - 5-pin male OR Molex mini-fit - 12-pin**	
M12	**Molex mini-fit**		
Pin 4	Orange	Split power supply V DC	Split power supply: 24 V DC with ≈28 mA current consumption. 48 V DC with ≈16 mA current consumption. The split power supply uses the common GND from the power supply (Blue). Split power supply is only for powering the communication of the integrated controller.
Pin 1	Red	Extends the actuator	The signal becomes active at: V_{IN} > 67% of V DC The signal becomes inactive at: V_{IN} < 33% of V DC Input current: 10 mA
Pin 2	Black	Retracts the actuator	
Pin 3	Violet	Parallel data +	The Parallel drive function will support up to 8 actuators running simultaneously. It is possible to run Parallel with a main power supply or separate power supplies.
Pin 5	White	Parallel data -	
PIN out		**Data cable M12 - 4-pin female OR RJ45**	
M12	**RJ45**		
Pin 1	Pin 1	ETH_TX+	
Pin 2	Pin 3	ETH_RX+	
Pin 3	Pin 2	ETH_TX-	
Pin 4	Pin 6	ETH_RX-	

Protection

Current limit

Current limits can be configured to avoid crushing when meeting an obstacle. These values can be adjusted according to your preferences. Use default values or fine-tune your current limits with 0.25 A/bit.

It is important to note that current limits should not be relied upon as a general stop function, as this will potentially stress the mechanics and could lead to long-term damage to the actuator.

Furthermore, current limits do not correlate directly with the actuator's load curves, meaning they should not be used as indicators of load. Various tolerances in components such as the spindle, nut, and gears can also affect the current consumption of the actuator. Operation in environments with temperatures below 0°C will also increase the current consumption. When temperature drops below 0°C, the default current limit will change to a higher value.

Actuator specific current limit values (above and below reference temp.) can be found in the respective actuator user manual or in the Actuator Connect service tool under 'Protection'.

Parallel

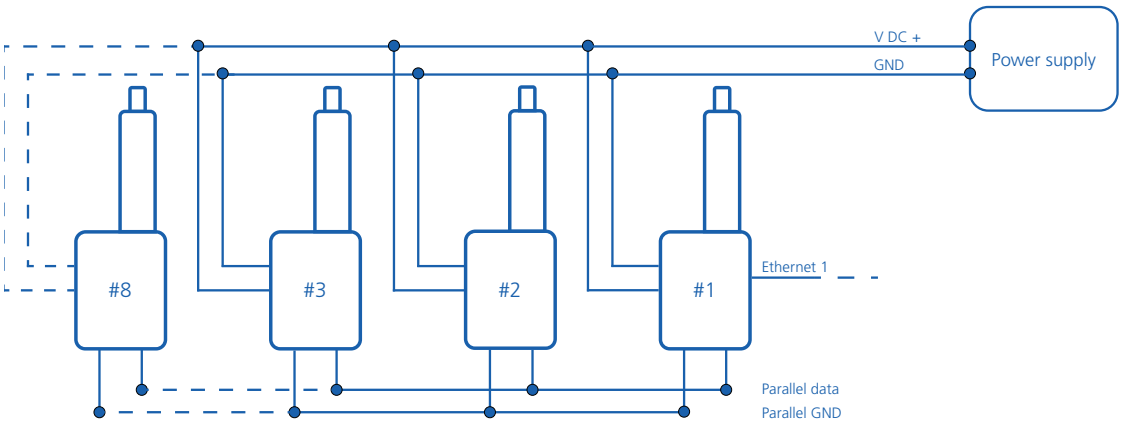
The industrial LINAK® actuators can be ordered with parallel functionality. If this feature is enabled, it is possible to run up to 8 actuators in a parallel system with just one actuator occupying an Ethernet port connection. The system works as a critical parallel, meaning that all actuators must be present in the system and have the exact same configuration (both mechanical and software functionality).

Below is a checklist to ensure that the system operates as intended:

Action	Description
Set up parallel in Actuator Connect™	Each actuator must be configured to operate in parallel (2-8 actuators). This can be set up using the Actuator Connect tool. *Please note: In some cases this is pre-configured from factory.*
Wire up the system	The actuators feature internal communication for parallel synchronisation and error codes.
Check cable lengths	Keep the total length of the communication line below 40 meters to avoid communication dropouts. In a parallel system with 8 actuators this would result in signal cable lengths of <5 metres.
Check power supply	It is also possible to use two or more separate power supplies in parallel under the condition that they have the same voltage and wattage output. It is essential that all power supplies share a common ground connection (Blue wire). Please respect actuator specifications regarding voltage level and current consumption!

Parallel

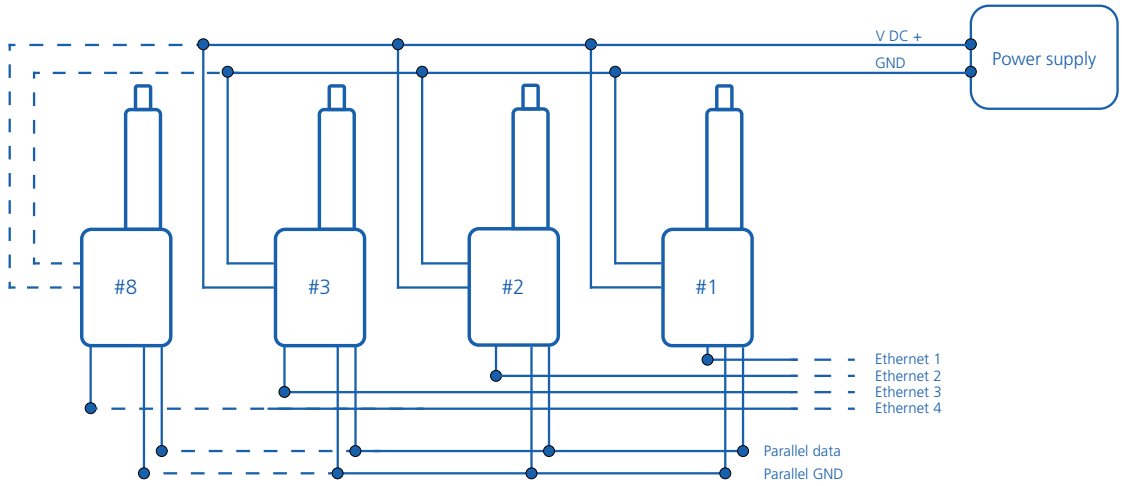
Option 1 - A simple parallel setup



In a simple parallel setup there is only one actuator connected to the network. This actuator receives run commands and shares data with the controller. The remaining actuators in the system are only connected to internal parallel communication. This way, the internal communication ensures that the system operates in parallel and stops in case of an obstacle, or when other errors occur on one of the actuators.

The actuators share simple error messages with the master, which can be distributed via the network.

Option 2 - Bus communication on all actuators



If there is a need for e.g. monitoring the real-time data of each actuator, it is possible to connect all actuators as nodes to the network. This will provide comprehensive usage data, which can be used to enhance performance in the application. Similar to option 1, this requires that all actuators are connected to internal parallel communication.

It is also possible to use two separate power supplies in parallel under the condition that they have the same voltage and wattage output. It is essential that both power supplies share a common ground connection (Blue wire).

Getting started

This section further describes how to communicate with LINAK® PROFINET actuators and contains examples of typical user scenarios and application solutions. All examples include references to registers which are further described in detail below.

The LINAK actuator is a PROFINET input and output peripheral device. It is integrated into a PROFINET network as a follower. This means that the actuator uses data from the master on the PROFINET (output data) and also produces data for the PROFINET itself (input data).

PROFINET defines real-time communication for the fast transmission of process data.

PROFINET GSDML

A GSDML file defines the specifications and functionality of a PROFINET device, enabling engineering tools to integrate and configure it within a network. It includes essential communication details such as device identification, vendor name, model number, parameters, and even the device image. By importing this file, engineers can seamlessly add the device to their project, ensuring compatibility and proper operation with other components, regardless of the manufacturer.

The LINAK_GSDML file is available for download by using the following link: LINAK_PROFINET_GSDML.zip

Power supply

PROFINET actuators are available with the following supply voltage range: 24 and 48 V DC. The accepted supply voltage range is specified for the version as shown below:

Supply voltage	Function	Voltage range		
		V_{IN}	V_{TYP}	V_{MAX}
24 V	Motor	18 V	24 V	32 V
	PROFINET communication	10 V	24 V	39 V
48 V	Motor	36 V	48 V	58 V
	PROFINET communication	10 V	48 V	60 V

For more information about wiring/connector, please see the connection diagram.

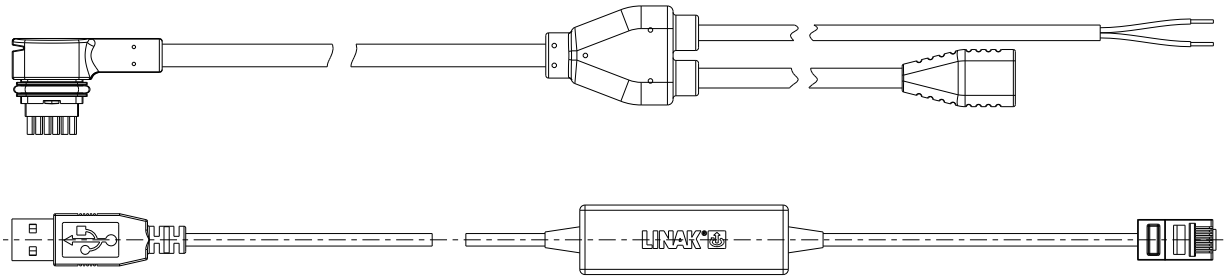
Configuration

Before being integrated into a PROFINET system, a few of the actuator parameters must be checked and eventually changed. This preparation is done via the use of the configuration tool Actuator Connect™ and guarantees that the actuator is able to execute basic functionality.

Further fine-tuning may be required to fulfil system or application requirements. Via this tool it is also possible to access historical usage data and real-time monitoring.

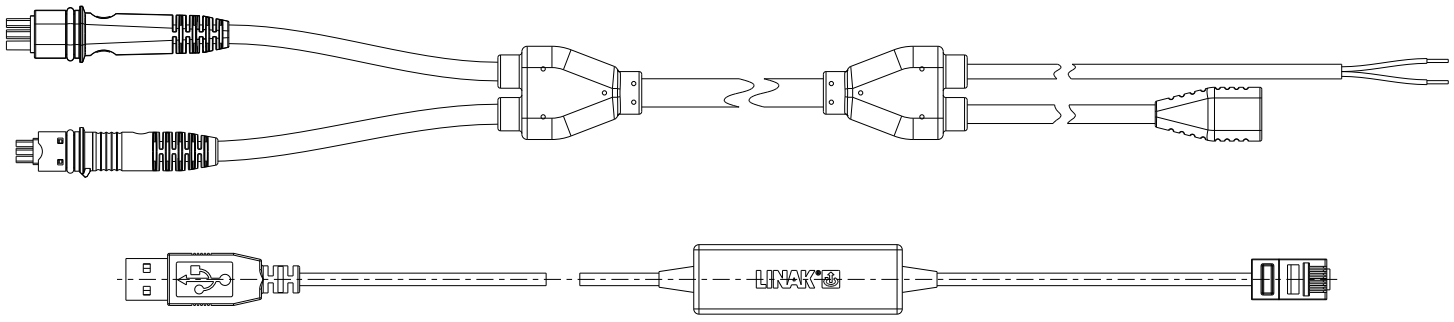
Valid for LA14 and LA25:

A separate configuration cable kit (item no. 0257901 = straight Y-cable + USB2LIN) is required to use Actuator Connect™ on a PC. This cable must be connected to the 9-pin connector on the actuator side. On the opposite side, power must be applied to the flying leads, and the USB connector must be inserted into your PC.



Valid for LA21, LA33, LA36, LA37, LA73, LA76, LA77, and LC3 IC:

A separate configuration cable (item no. 0367996) is required to use Actuator Connect on a PC. This cable must be connected to the 6-pin and 9-pin connector on the actuator side. On the opposite side, power must be applied to the Brown (V DC) and Blue (GND) wires, and the USB connector must be inserted into your PC.



For more information about wiring/connector, please see the connection diagram.

Parameters to be verified by Actuator Connect™

Parameters	Description
Device name	Assign device name.
DHCP	DHCP is a client/server protocol that automatically provides an IP address. **If enabled: below parameters are not configurable**
IP address	Set the device IP address to a unique address in the network. 192.168.1.10 (default)
Subnet mask	Set the subnet mask. 255.255.255.0 (default)
Gateway	Set the gateway. 192.168.1.1 (default)

The device's IP address can also be configured or modified using Siemens engineering tools such as TIA Portal or PRONETA. Both tools allow you to assign network parameters and update the device's IP settings during commissioning or maintenance. Ensure that any changes made to the IP address align with your system's network design and do not result in address conflicts.

Users are strongly advised against configuring their assets directly to the public internet. By taking this precautionary measure, the risk of unauthorized and malicious cyber activities from external threats is significantly reduced.

Command examples

Before the actuator can engage movement, some general prerequisites must be fulfilled. Timing (e.g. when the actuator is still moving), environmental conditions and errors might mean that the actuator is in a state where further operation is not possible.

General run prerequisites

Step	Read/ Write	Process data*	Action
1	W	Command Byte 0 Byte 1	"Position" must be set to = 64259 [0xFB03] for 'Stop'. To prevent unintended movement, it is required to send a 'Stop' command before running the actuator.
2	R	Feedback Byte 6 Byte 7	"Error Code" must be = 0 [0x00]
3		Feedback Byte 4 Byte 5	"Status Flags" bit 2 (Overcurrent) must be = 0
4		Feedback Byte 4 Byte 5	"Status Flags" bit 5 (Heartbeat needed) must be = 0
5		Feedback Byte 4 Byte 5	"Status Flags" bit 6 (Actuator is running outside nominal conditions) must be = 0

* Feedback = Process Data In / Command = Process Data Out

Run the actuator outwards

Step	Read/ Write	Process data*	Action
1		-	Check that general run prerequisites are fulfilled.
2	W	Command Byte 2 Byte 3	"Current" must be set to a value. 0-250 [0x00-FA] = Current limit 0.25 A/bit 251 [0xFB] = Default current limit set via Actuator Connect™ 252-255 [0xFC-FF] = Reserved
3		Command Byte 4 Byte 5	"Speed" must be set to a value. 0-200 [0x00-FA] = Speed 0.5% /bit 201-250 [0xC9-FA] = 100% speed 251 [0xFB] = Default speed set via Actuator Connect 252-255 [0xFC-FF] = Reserved
4		Command Byte 6 Byte 7	"Ramp Up" must be set to a value. 0-200 [0x00-FA] = Start ramp time 0.05 s/bit 251 [0xFB] = Default speed set via Actuator Connect 252-255 [0xFC-FF] = Reserved
5		Command Byte 8 Byte 9	"Ramp Down" must be set to a value. 0-200 [0x00-FA] = Stop ramp time 0.05 s/bit 251 [0xFB] = Default speed set via Actuator Connect 252-255 [0xFC-FF] = Reserved
6		Command Byte 0 Byte 1	"Position" must be set to = 64257 [0xFB01] for 'Run out.'
7**	R	Feedback Byte 4 Byte 5	"Status Flags" bit 3 and bit 1 change to 1 to indicate that: Bit 3 = Actuator is running out Bit 1 = Endstop reached out

* Feedback = Process Data In / Command = Process Data Out
** Optional

Run the actuator to target position (150 mm)

Step	Read/ Write	Process data*	Action
1		-	Check that general run prerequisites are fulfilled.
2	W	Command Byte 2 Byte 3	"Current" must be set to a value. 0-250 [0x00-FA] = Current limit 0.25 A/bit 251 [0xFB] = Default current limit set via Actuator Connect™ 252-255 [0xFC-FF] = Reserved
3		Command Byte 4 Byte 5	"Speed" must be set to a value. 0-200 [0x00-FA] = Speed 0.5% /bit 201-250 [0xC9-FA] = 100% speed 251 [0xFB] = Default speed set via Actuator Connect 252-255 [0xFC-FF] = Reserved
4		Command Byte 6 Byte 7	"Ramp Up" must be set to a value. 0-200 [0x00-FA] = Start ramp time 0.05 s/bit 251 [0xFB] = Default speed set via Actuator Connect 252-255 [0xFC-FF] = Reserved
5		Command Byte 8 Byte 9	"Ramp Down" must be set to a value. 0-200 [0x00-FA] = Stop ramp time 0.05 s/bit 251 [0xFB] = Default speed set via Actuator Connect 252-255 [0xFC-FF] = Reserved
6		Command Byte 0 Byte 1	"Position" must be set to = 1500 [0x05DC] for 'Run to Target Position 150 mm'
7**	R	Feedback Byte 4 Byte 5	"Status Flags" bit 3 or bit 4 change to 1 to indicate that either: Bit 3 = Actuator is running out Bit 1 = Actuator is running in

* Feedback = Process Data In / Command = Process Data Out
** Optional

Overcurrent state

If an overcurrent occurs, the actuator will be stopped and blocked in that direction until an activation in the opposite direction has been made or the system has been re-powered.

Step	Read/ Write	Process data*	Action
1	R	Feedback Byte 4 Byte 5	Confirm that "Status Flags" bit 2 is = 1 for 'Overcurrent'
2	W	Command Byte 0 Byte 1	"Position" must be set to run in the opposite direction of the blockage Set to = 64257 [0xFB01] for 'Run out' or Set to = 64258 [0xFB02] for 'Run in'
3**	R	Feedback Byte 4 Byte 5	"Status Flags" bits change to 1 to indicate that either: Bit 3 = Actuator is running out Bit 4 = Actuator is running in Bit 1 = Endstop reached out Bit 0 = Endstop reached in

* Feedback = Process Data In / Command = Process Data Out
** Optional

Clear error

If an error occurs, the actuator will be stopped, and normal movement will not be possible.

Step	Read/ Write	Process data*	Action
1	R	PDI Byte 6-7	Confirm that “Error Code” is not = 0
2	W	PDO Byte 0-1	“Position” set to = 64256 (Clear Error Codes)
3	R	PDI Byte 6-7	Confirm that “Error Code” is = 0 If “Error Code” is not = 0, then correct the error in the system and repeat step 2.

* PDI = Process Data In / PDO = Process Data Out

Process data

In a PROFINET IO system, process data consists of cyclically exchanged data between an IO Controller (such as a PLC) and an IO Device (field device).

This input or output data is stored in the controller's process image and used by its application program to monitor and control processes.

Process Data Out (Command)

Command **Module ID 48 SLOT 1** Real-time cyclic data exchanged									
Byte 9 [MSB]	**Byte 8**	**Byte 7**	**Byte 6**	**Byte 5**	**Byte 4**	**Byte 3**	**Byte 2**	**Byte 1**	**Byte 0 [LSB]**
Ramp Down		Ramp Up		Speed		Current Limit		Position	

Module ID 48 SLOT 1					
Byte(s)	**Command**	**Data type**	**Details**	**Description**	**Scaling**
Byte 0-1	Position	UINT16	0-64255	Run to position	0.1 mm /bit
			64256	Clear Error Codes (see Process Data In Byte 6 and 7)	
			64257	Run out	
			64258	Run in	
			64259	Stop	
			64260	Recovery run out	
			64261	Recovery run in	
			64262-65535	Invalid value, actuator will not run	
Byte 2-3	Current Limit	UINT16	0-250	Maximum current limit	0.25 A /bit
			251	Default current limit	
			252-255	Invalid value, actuator will not run	
Byte 4-5	Speed	UINT16	0-200	Speed	0.5% /bit
			201-250	100% speed	
			251	Default speed	
			252-255	Invalid value, actuator will not run	
Byte 6-7	Ramp Up	UINT16	0-250	Ramp up time	0.05 s /bit
			251	Default ramp up value	
			252-255	Invalid value, actuator will not run	
Byte 8-9	Ramp Down	UINT16	0-250	Ramp down time	0.05 s /bit
			251	Default ramp down value	
			252-255	Invalid value, actuator will not run	

Process Data In (Feedback)

Feedback Module ID 49 (0x31) SLOT 2 Real-time cyclic data exchanged											
Byte 11	**Byte 10**	**Byte 9**	**Byte 8**	**Byte 7**	**Byte 6**	**Byte 5**	**Byte 4**	**Byte 3**	**Byte 2**	**Byte 1**	**Byte 0 [LSB]**
AUX Inputs		Speed		Error Code		Status Flags		Current Draw		Position	

Module ID 49 SLOT 2					
Byte(s)	**Command**	**Data type**	**Details**	**Description**	**Scaling**
Byte 0-1	Position	UINT16	0-64255	Position of the actuator	0.1 mm /bit
			64256-65023	Reserved	
			65024	Position lost	
			65025-65535	Reserved	
Byte 2-3	Current Draw	UINT16	0	Not running	0.25 A /bit
			1-250	Motor current draw	
			251-253	Reserved	
			254	Fault in current measurement circuit	
			255	Reserved	
Byte 4-5	Status Flags	UINT16	b0	Endstop reached in	Bit-independent status indicators
			b1	Endstop reached out	
			b2	Overcurrent	
			b3	Running out	
			b4	Running in	
			b5	Communication heartbeat needed	
			b6	Actuator is running outside nominal conditions	
			b7	Reserved. Always high	
			b8-b15	Reserved	
Byte 6-7	Error Code*	UINT16	0	No error detected	8-bit error code showing the current active error with the highest priority only
			1	Power on block state	
			2	Position sensor	
			3	Overvoltage	
			4	Undervoltage	
			5	Communication sync.	
			6	Endstop switch	
			7	Temperature	

* See Error Code descriptions in section: Error codes

Process Data In (Feedback)

Module ID 49 SLOT 2					
Byte(s)	**Command**	**Data type**	**Details**	**Description**	**Scaling**
Byte 6-7	Error Code*	UINT16	8	Motor controller	8-bit error code showing the current active error with the highest priority only
			9	Internal power supply	
			10	Internal current measurement	
			11	Parallel arbitration	
			12	Position not changing	
			13	Position initialisation not possible	
			14	Alone in parallel system	
			15	Incorrect number in parallel system	
			16	Hardware	
			17	BLDC motor	
			18	Parallel communication	
			19	Parallel running	
			20	Parallel setup stopped	
			254	Other internal error (Not specified)	
			255	Other external error (Not specified)	
Byte 8-9	Speed	UINT16	0-4015	Speed of actuator	0.1 mm/s /bit
			4016-65535	Reserved	
Byte 10-11	AUX Inputs	UINT16	b0-b1	Input 1 level	1 bit/ 25% VCC
			b2-b3	Input 2 level	
			b4-b15	Reserved	

* See Error Code descriptions in section: Error codes

Process Data In (Parallel Feedback)

Parallel Feedback Module ID 49 SLOT 2 Real-time cyclic data exchanged							
Byte 19	**Byte 18**	**Byte 17**	**Byte 16**	**Byte 15**	**Byte 14**	**Byte 13**	**Byte 12**
Parallel Status Flags		Parallel Error Code		Parallel Error Source			

Module ID 49 SLOT 2					
Byte(s)	**Command**	**Data type**	**Details**	**Description**	**Scaling**
Byte 12-15	Parallel Error Source	UINT32	0	No error detected	
			1-4.294.967.295	IP address of the actuator with highest priority error	Decimal to IPv4
Byte 16-17	Parallel Error Code*	UINT16	0	No error detected	8-bit error code indicating the current active error of highest priority on any actuator in the parallel system
			1	Current overload	
			2	Hardware	
			3	Temperature	
			4	Overvoltage	
			5	Undervoltage	
			6	Analogue input out of range error	
			7	Position not changing	
			8	Power on block state	
			9	Position initialisation not possible	
			10	Parallel start-up	
			11	Parallel running	
			12	BLDC motor	
			13	Endstop switch	
			14	Parallel communication	
			15	Parallel setup stopped	
			24	Other error	
			25	Position lost	
Byte 18-19	Parallel Status Flags	UINT16	b0	Parallel endstop reached out	Bit-independent status indicators
			b1	Parallel endstop reached in	
			b2	Parallel running outside nominal conditions	
			b3-b15	Reserved. Always high	

* See Parallel Error Code descriptions in section: Parallel error codes

Data records

PROFINET data records are blocks of information in an IO device that can be read or written acyclically using RDREC and WRREC functions. They are used for tasks like device configuration, storing Identification and Maintenance (I&M) data, and providing diagnostics information.

These records are addressed by a combination of Slot, Subslot, and Index.

Configuration

Configuration **Module ID 50 SLOT 3** Acyclic data exchange						
Index	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**Access**
0	Current Limit - Outwards	UINT8	0-255	Works only when PDO "Current Limit" is 251*	0.25 A/bit	R/W
1	Current Limit - Inwards					
2	Ramp Up - Outwards	UINT16	0-65535	Works only when PDO "Ramp Up" is 251	1 ms/bit	R/W
3	Ramp Up - Inwards					
4	Ramp Down - Outwards			Works only when PDO "Ramp Down" is 251		
5	Ramp Down - Inwards					
6	Maximum Speed	UINT8	0-200	Overrules PDO "Speed"	0.5% /bit	R/W
			201-255		100%	
7	Virtual Endstop - Outwards	UINT16	0	Sets the Virtual Endstop Outwards position	Disabled	R/W
			1-699		Do NOT set below 70 mm**	
			700-65535		0.1 mm/bit	
8	Virtual Endstop - Inwards	UINT16	0	Sets the Virtual Endstop Inwards position	Disabled	R/W
			1-350		0.1 mm/bit	
			351-65535		Do NOT set above 35 mm**	

* Actuator must power cycle before changes apply.

** Virtual limits set in the Initialisation zone will make Initialisation impossible.

Diagnostics

Diagnostics Module ID 50 SLOT 3 Acyclic data exchange						
Index	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**Access**
9	UIN	UINT32		Unique 8-digit identification number		R
Software						
10	Variant	UINT32		SWxxxxxxxVx-x		R
11	Version Major			SWxxxxxxxVx-x		
12	Version Minor			SWxxxxxxxVx-x		
13	Config. Production Order Number	UINT32		Unique 8-digit identification number		R
14	Production Date			yyyymmdd		
15	Max. Current Seen	UINT8		0.25 A/bit		
16	Max. FET Temperature Seen			1°C /bit - 40°C		
17	Max. Ambient Temperature Seen					
18	Min. Ambient Temperature Seen					
19	Total Current Usage	UINT32		1 (Ampere*seconds)/bit		
20	Total Runtime			1 s/bit		
Number of stops due to						
21	Overvoltage	UINT8		Number of stops		R
22	FET Overtemperature					
23	Ambient Overtemperature					
24	Undervoltage					
25	Hall Error					
26	Endstop Switch Error					
27	Default Current Limit Overloads - Out					
28	Default Current Limit Overloads - In					

Diagnostics

Diagnostics Module ID 50 SLOT 3 Acyclic data exchange						
Index	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**Access**
Number of resettable stops due to						
29	Custom Current Limit Overloads - Out	UINT8		Can be used to keep track of current overload stops from the last reset. Can only be set to 0.		R/W
30	Custom Current Limit Overloads - In					
Number of						
31	Communication Errors	UINT16		Number of		R
32	Endstop Reached - Out	UINT32				
33	Endstop Reached - In					
34	Starts - Out					
35	Starts - In					
36	Total Piston Distance Traveled	UINT32		5 m/bit		R
Reason for Last Stop – ID 0: See Reason for Last Stop definitions in section below						
37	Reason	UINT16		Reason for stop		R
38	Count	UINT8		Number of stops in a row		
39	Powered Time	UINT32		Powered time when the last stop occurred	1 s/bit	
Reason for Last Stop – ID 1: See Reason for Last Stop definitions in section below						
40	Reason	UINT16		Reason for stop		R
41	Count	UINT8		Number of stops in a row		
42	Powered Time	UINT32		Powered time when the last stop occurred	1 s/bit	
Reason for Last Stop – ID 2: See Reason for Last Stop definitions in section below						
43	Reason	UINT16		Reason for stop		R
44	Count	UINT8		Number of stops in a row		
45	Powered Time	UINT32		Powered time when the last stop occurred	1 s/bit	
Reason for Last Stop – ID 3: See Reason for Last Stop definitions in section below						
46	Reason	UINT16		Reason for stop		R
47	Count	UINT8		Number of stops in a row		
48	Powered Time	UINT32		Powered time when the last stop occurred	1 s/bit	

Diagnostics

Diagnostics Module ID 50 SLOT 3 Acyclic data exchange						
Index	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**Access**
Reason for Last Stop – ID 4: See Reason for Last Stop definitions in section below						
49	Reason	UINT16		Reason for stop		R
50	Count	UINT8		Number of stops in a row		
51	Powered Time	UINT32		Powered time when the last stop occurred	1 s/bit	
52	Total Corrected Distance	UINT32		1 mm/bit		R
53	FET Temperature	UINT8		1°C /bit - 40°C		
54	Ambient Temperature					
55	Number of Hall Shifts at Learn	UINT16		0.1 mm/bit		
56	Zero Point Offset at Learn					
57	Production Order Number	UINT32		Unique 8-digit identification number		
LINAK Special Functions						
58	Functions	UINT8	0	Reserved		R/W
			1	Restart actuator		
			2-255	Reserved		
UIN in Parallel System						
59	UIN 1	UINT32		Sorted in descending order		R
60	UIN 2					
61	UIN 3					
62	UIN 4					
63	UIN 5					
64	UIN 6					
65	UIN 7					
66	UIN 8					
67	Powered Time	UINT32		1 s/bit		R
68	Remaining Life	UINT8	0-100	Remaining life (Counting down)	1% /bit	
			101-249	Reserved		
			250	Remaining life not supported		
			251-255	Reserved		

Reason for Last Stop definition

Reason for last stop	Function	Description
1	H-bridge fault	There is a hardware problem causing the system to malfunction or the gate driver to not respond correctly.
2	Overtemperature	The device or the surrounding temperature got too hot while it was running.
4	Undervoltage	The voltage dropped below the required level while it was running.
8	Overcurrent	Current consumption exceeded the limit, resulting in a time-out or an actuator stall.
16	SMPS fault	The 12 V and/or 5 V levels are not within the normal range.
32	Endstop fault	Both EOS switches were turned on at the same time while running.
64	Hall fault	One Hall sensor changed more than 10 times while the motor voltage was high, but the other sensor did not change.
256	Overvoltage	The voltage went too high while it was running, probably because of the braking.
512	Position not changing	Even though power is above the level needed for the motor to turn, the position doesn't change.
1024	Hardware fault	A hardware problem has occurred. Possible reasons might include issues with the gate driver, incorrect current measurements, or a malfunctioning motor sensor.
2048	Communication drop-out	The source of the request stopped, or the signal was lost.
4096	Change of interface	The actuator is connected to a more important system than the one that made the request.
4097	Parallel master detected a change in the number of connected followers	The parallel system stopped because a registered device disconnected, or a new device connected.
4098	Parallel master was stopped by a follower	A parallel master stopped running because a follower requested the master to hard stop.
4099	Parallel follower lost connection to master	A parallel follower stopped running because the connection to the master was lost.
4100	Parallel communication fault	An actuator in the parallel system stopped working because it had too many communication errors in a short time.

FAQ

Problem	Cause / Solution
Why is the actuator not running despite giving it a 'Run' command?	1. Make sure that power is applied from the power supply. 2. Send a 'Clear error' 0xFB00 (64256) command before sending a 'Run' command. 3. Make sure that the configuration parameters Max. Speed 0x06, Current Limit Out 0x00 and Current Limit In 0x01 are not set to '0'.
Where can I find the latest GSDML file?	At LINAK.com
Why does the PLC show a reversed data order?	On most PLCs, the GSDML file will ensure the correct order of data input/output bytes according to the 'Process data' table. However, some controllers may reverse the data order. Please make sure the correct Most Significant Byte [MSB] and Least Significant Byte [LSB] are matching your configuration. If you experience maximum feedback data values (Position, Current and/or Speed), 0xFF (255) for byte data types and 0xFFFF (65535) for integer data types, the order is most likely reversed.
What is the highest priority process or parameter and diagnostic data?	Commonly referred to as cyclic and acyclic data. For example, current limit value in amps can be set in both cyclic and acyclic data. In this case, the lowest value determines when the actuator will stop.
Is the data order of received "Feedback" correct? or Do I have a working connection?	If you are unsure whether you have a working connection or if your data order is correct, you can look for the Status Flags byte in the feedback data. The Status Flags byte will always have a value higher than "0", because bit 7 is always "1". Typically, the byte value will be "1000 0001" Binary or "81" Decimal, indication "Endstop reached in". This value should show in byte 3 of received feedback bytes.

Error codes

All error codes apply to the entire TECHLINE® interface portfolio; some may not relate to your specific interface or product type.

Error	Description
0	**No error detected** No LINAK defined error detected.
1	**Power on block state** As a safety precaution to prevent unintentional movement at power-up, the actuator will not run until a 'Stop' command or 'Clear error' command has been sent.
2	**Position sensor** Position sensors are outside of expected operating range. Example: 10 pulses were reported on one Hall sensor and no Hall pulses on the other. Send 'Clear error' command to clear error. If the error persists, contact LINAK or replace the product.
3	**Overvoltage** Input supply voltage is above operating voltage level. Consult the documentation for correct voltage levels. The error will automatically be cleared when voltage is within operating limits.
4	**Undervoltage** Input supply voltage is below operating voltage level. The error can only be cleared by sending a 'Clear error' command once the voltage is within the acceptable range. Consult the documentation for correct voltage levels.
5	**Communication sync.** Heartbeat from the master is not within the expected heartbeat interval. Consult the documentation for minimum requirements for heartbeat interval.
6	**Endstop switch** Endstop switches are behaving unexpectedly. Example: Both endstop switches have been activated simultaneously for more than 100 ms. Perform the initialisation process by running the actuator fully extended and retracted.
7	**Temperature** Internal actuator temperature is above operating limit. Consult the documentation for correct temperature levels. The error will automatically be cleared when the temperature is within operating limits.
8	**Internal motor controller** Internal motor controller hardware error. Send 'Clear error' command to clear error. If the error persists, contact LINAK or replace the product.
9	**Internal power supply** The internal power supply is behaving unexpectedly. Send 'Clear error' command to clear error. If the error persists, contact LINAK or replace the product.
10	**Internal current measurement** Internal current reference is outside the expected limits. Send 'Clear error' command to clear error. If the error persists, contact LINAK or replace the product.
11	**Parallel arbitration** Start-up parallel configuration procedure in progress.
12	**Position not changing** Internal position sensor is behaving unexpectedly and motor might stall. Please check your application for blockage or other irregularities. If the error persists, contact LINAK or replace the product.
13	**Position initialisation not possible** Internal initialisation parameters missing. Contact LINAK.

Error codes

Error	Description
14	**Alone in parallel system** Incorrect number of actuators in parallel system.
15	**Incorrect number in parallel system** Incorrect number of actuators in parallel system or wrongly configured.
16	**Hardware** There is an internal motor controller malfunction affecting the actuator's ability to operate correctly. Contact LINAK.
17	**BLDC motor** Position sensors are outside of expected operating range. Example: 10 pulses were reported on one Hall sensor and no Hall pulses on the other. Send 'Clear error' command to clear error. If the error persists, contact LINAK or replace the product.
18	**Parallel communication** There are issues with the communication setup among the master and the follower devices. Make sure all cables are secured properly in the connectors.
19	**Parallel running** Parallel out of sync.
20	**Parallel setup stopped** The parallel master was stopped by a follower with some fault. To diagnose the specific issue, refer to the separate parallel feedback where the error codes from the followers can be read for more detailed information.
254	**Other internal error (Not specified)** Unspecified internal hardware/software error. Send 'Clear error' command to clear error. If the error persists, contact LINAK or replace the product.
255	**Other external error (Not specified)** Unspecified external hardware/software error. Please inspect your application for possible issues. Send 'Clear error' command to clear error.

Parallel error codes

All error codes apply to the entire TECHLINE® interface portfolio; some may not relate to your specific interface or product type.

Error	Description
0	**No error detected** No LINAK defined error detected.
1	**Current overload** Current draw is above allowed operating limit. Reduce load, send a 'Clear error' command, and run the actuator in the opposite direction.
2	**Hardware** Internal hardware error. Send 'Clear error' command to clear error. If the error persists, contact LINAK or replace the product.
3	**Temperature** Internal actuator temperature is above operating limit. Consult the documentation for correct temperature levels. The error will automatically be cleared when the temperature is within operating limits.
4	**Overvoltage** Input supply voltage is above operating voltage level. Consult the documentation for correct voltage levels. The error will automatically be cleared when voltage is within operating limits.
5	**Undervoltage** Input supply voltage is below operating voltage level. Consult the documentation for correct voltage levels. The error will automatically be cleared when voltage is within operating limits.
6	**Analogue input out of range** Analogue input signal is outside operating limits. Servo or Proportional. Consult the documentation for correct input signal.
7	**Position not changing** Internal position sensor is behaving unexpectedly and motor might stall. Please check your application for blockage or other irregularities. If the error persists, contact LINAK or replace the product.
8	**Power on block state** Communication has been overruled by a higher priority input. Communication is split into the following priorities: 1. Bus communication (CAN bus, EtherNet/IP, etc.) 2. LINAK service tool (Actuator Connect™) 3. Manual run using Red and Black wires Send a 'Clear error' command to continue.
9	**Position initialisation not possible** Internal initialisation parameters missing. Contact LINAK.
10	**Parallel start-up** Error in parallel setup. The number of connected actuators does not match your configuration. Check the configuration by using the LINAK tool Actuator Connect.
11	**Parallel running** The actuators are performing the internal setup and are not ready for operation.

Parallel error codes

Error	Description
12	**BLDC motor** Internal hardware error. Send 'Clear error' command to clear error. If the error persists, contact LINAK or replace the product.
13	**Endstop switch** Endstop switches are behaving unexpectedly. Both endstop switches have been activated simultaneously for more than 100 ms. Perform the initialisation process by running the actuator fully extended and retracted.
14	**Parallel communication** Error in internal parallel communication. More than 5 communication errors in 500 ms. Please check the wire connections and re-power the complete setup.
15	**Parallel setup stopped** One or more actuators cannot comply with commands and stop. Master commands 'Stop' to other actuators in the network. Send 'Clear error' command to clear error. If the error persists, check your application and wire connections and re-power your complete setup.
24	**Other error** Actuator receives an undefined error code. This can be due to outdated firmware. Send 'Clear error' command to clear error. If the error persists, contact LINAK or replace the product.
25	**Position lost** The actuator has lost track of its position. Please run the actuator completely inwards and run outwards past the area from 35-70 mm to initialise the actuator.

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