TECHLINE®
IMPROVING FLEXIBILITY

EtherNet/IP™

User Manual



LINAK®
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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.

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Revision overview

Edition F

Voltages removed from connection diagram and I/O specifications	Page 6-8
Sentence regarding motor driver module removed	Page 8
Table for actuator specific voltage ranges added	Page 11
Number of pins in connectors removed from ‘Configuration’ section	Page 12
Step added to ‘Overcurrent state’ table	Page 17

Edition E

Connection diagram for linear actuators updated	Page 6
Connection diagram for LC3 IC updated	Page 7
I/O specifications updated	Page 8
Voltages removed from illustrations	Page 10
‘LED status indicator’ table added	Page 11
‘Normal’ changed to ‘nominal’	Page 14
‘Clear error’ table added	Page 17
Byte 2-5 in ‘Assembly Data Output (Command)’ changed to UINT8	Page 18
Status Flags b8-b15 removed	Page 19
‘Assembly Data In (Feedback)’ corrected to ‘Assembly Data Input (Feedback)’	Page 19-20
Byte 2-7 in ‘Assembly Data Input (Feedback)’ changed to UINT8	Page 19-20
8-bit independent changed to Bit-independent	Page 19+21
AUX Input b4-b15 changed to b4-b7	Page 20
Parallel Error Code and Parallel Status Flags changed to UINT8	Page 21
Parallel Status Flags b3-b15 changed to b3-b7	Page 21
Instance ID 20 updated in ‘Diagnostics’ section	Page 23
2047 corrected to 2048	Page 27
Parallel error code 25 - Position lost description updated	Page 31
‘Slave’ changed to ‘Follower’	All over the document

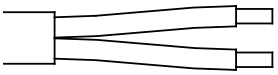
Edition D

Plug type added to plug view	Page 6
Item number for cable kit added	Page 6-7
‘Current limit’ section added	Page 9
Parallel ‘Check power supply’ updated	Page 9
EtherNet/IP EDS file information added	Page 11
Clear error in overcurrent situation’ changed to ‘Overcurrent state’	Page 17
‘Implicit messaging’ section updated	Page 18-21
‘Explicit messaging’ section updated	Page 22-28
‘Reason for Last Stop’ table updated	Page 27
Error codes updated	Page 28-29
Parallel error codes updated	Page 30-31
'Soft Start' changed to 'Ramp Up' + 'Soft Stop' changed to 'Ramp Down'	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
LA14, LA25, LA21, LA73 and LC3 IC added	All over the document

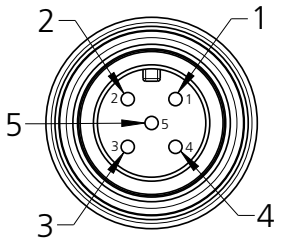
Connection diagram

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

BROWN	V DC
BLUE	GND

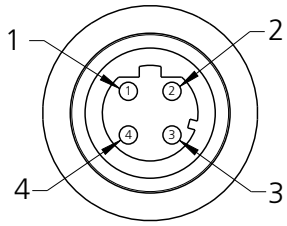


4	Split power supply V DC
1	Extends the actuator
2	Retracts the actuator
3	Parallel data +
5	Parallel data -



M12
A-Code male

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

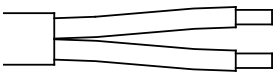


M12
D-Code female

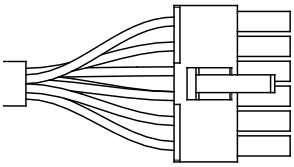
Connection diagram

Applicable for: LC3 IC

BROWN	V DC
BLUE	GND

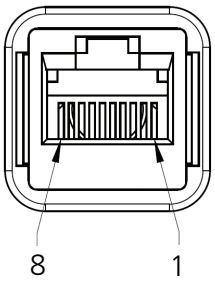


ORANGE	Split power supply V DC
RED	Extends the actuator
BLACK	Retracts the actuator
VIOLET	Parallel data +
WHITE	Parallel data -
YELLOW	Not to be connected
GREEN	Not to be connected
LIGHT BLUE	Not to be connected
GREY	Not to be connected



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.	EtherNet/IP
Brown		Connect Brown to positive V DC	Note: Do not change the power supply polarity on the Brown and Blue wires! 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 finetune 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

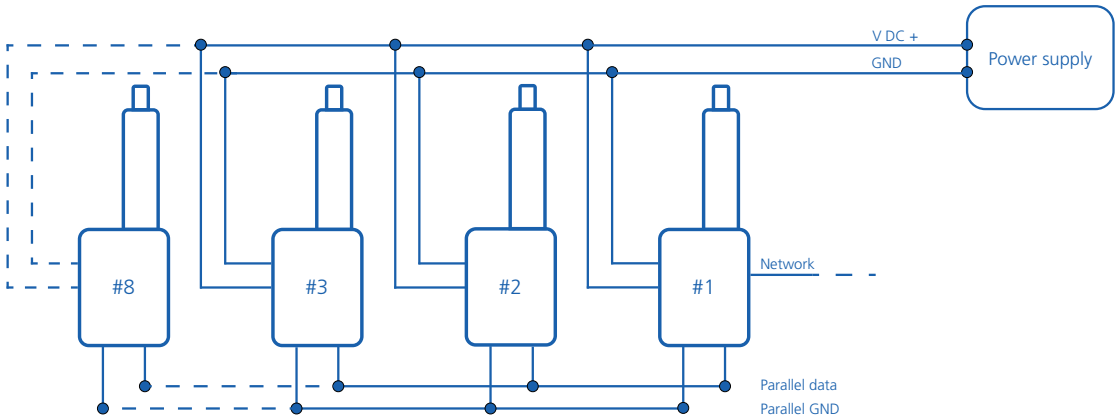
The industrial LINAK® actuators can be ordered with parallel functionality. If this feature is enabled, it is possible to run up to 8 actuators in a parallel system with just one actuator occupying an Ethernet port connection. The system works as a critical parallel, meaning that all actuators must be 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

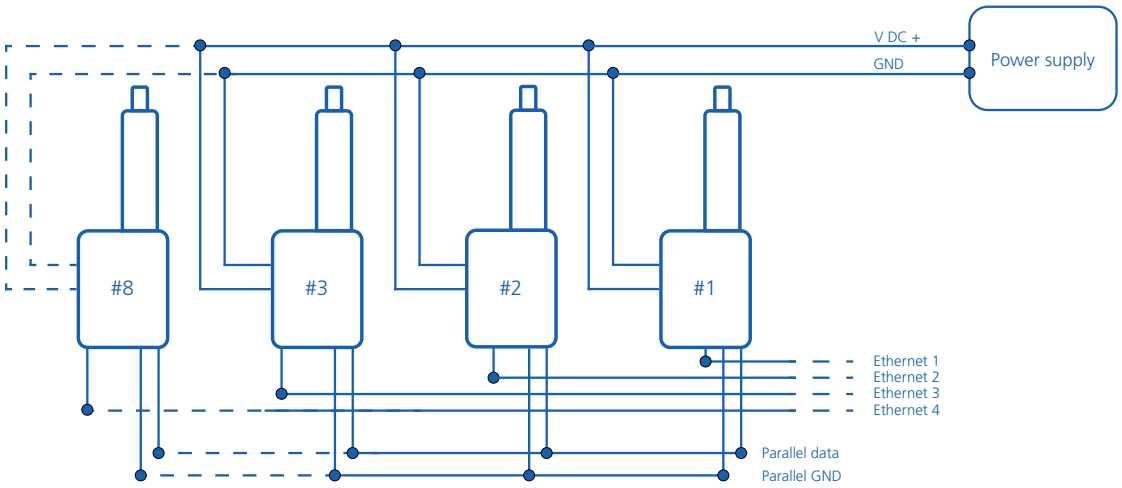
Option 1 - A simple parallel setup



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).

Diagnostics

LED status indicator

Some 9-pin and 12-pin actuators (not 6-pin) are equipped with an LED status indicator. The LED can show different colours, depending on the state of the actuator:

LED	Status
	OK
	Inoperative (external errors)
	Inoperative (internal errors)

Getting started

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

EtherNet/IP EDS

An Electronic Data Sheet (EDS) describes the configuration and capabilities of an EtherNet/IP device, enabling industrial automation software to correctly identify, configure, and communicate with it. These files include essential details such as device identity, input/output (I/O) data, and key parameters, making it easier to integrate the device into a network.

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

Power supply

EtherNet/IP actuators are available with the following supply voltage range: 24 and 48 V DC. Actuator specific voltage ranges are specified in the tables below:

	LA14	LA25	LA21	LA33	LA36	LA37	LA73	LA76	LA77	LC3 IC
24 V	√	√	√	√	√	√	√	√	√	√
48 V			√	√	√	√	√	√	√	√

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
	EtherNet/IP communication	10 V	24 V	39 V
48 V	Motor	36 V	48 V	58 V
	EtherNet/IP communication	10 V	48 V	60 V



For more information about wiring/connector, please see the Connection Diagram.

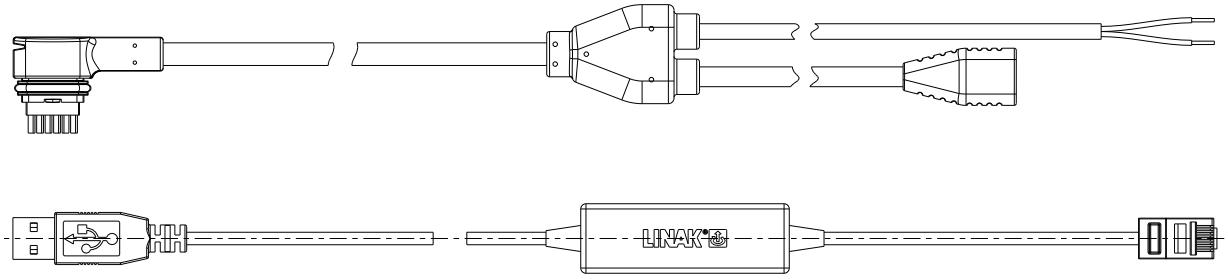
Configuration

Before being integrated into an EtherNet/IP 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.

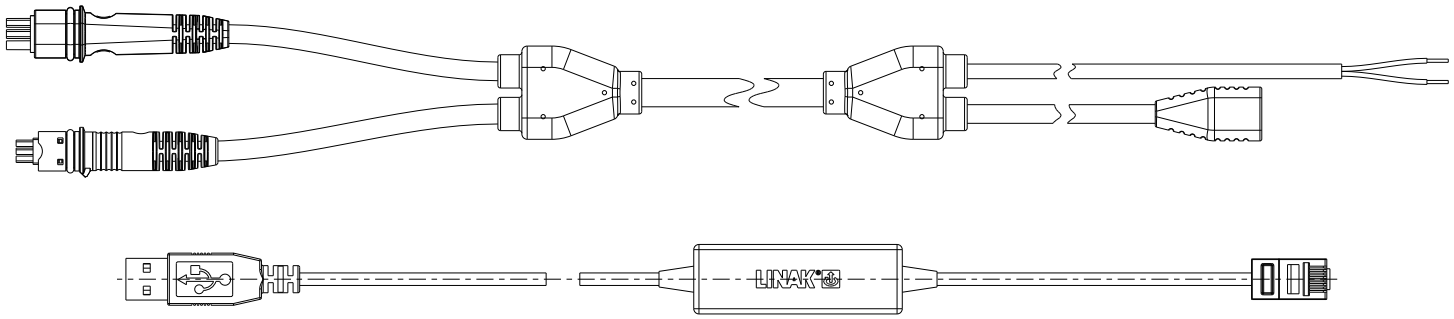
Valid for LA14 and LA25:

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 actuator. 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 actuator. On the opposite side, power must be applied to the flying leads, 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
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)

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 may indicate that the actuator is in a state where further operation is not possible.

General run prerequisites

Step	Read/ Write	Assembly Instance ID*	Action
1	W	Command details AID 150 [0x96] Byte 0-1	"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 status details AID 100 [0x64] Byte 4	"Error Code" must be = 0 [0x00].
3		Feedback status details AID 100 [0x64] Byte 3	"Status Flags" bit 2 (Overcurrent) must be = 0.
4		Feedback status details AID 100 [0x64] Byte 3	"Status Flags" bit 5 (Heartbeat needed) must be = 0.
5		Feedback status details AID 100 [0x64] Byte 3	"Status Flags" bit 6 (Actuator is running outside nominal conditions) must be = 0.

* AID 100 = Feedback / AID 150 = Command

Run the actuator outwards

Step	Read/ Write	Assembly Instance ID*	Action
1		-	Check that general run prerequisites are fulfilled.
2	W	Command details AID 150 [0x96] Byte 2	"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 details AID 150 [0x96] Byte 3	"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 details AID 150 [0x96] Byte 4	"Ramp Up" must be set to a value. 0-250 [0x00-FA] = Start ramp time 0.05 s/bit 251 [0xFB] = Default speed set via Actuator Connect 252-255 [0xFC-FF] = Reserved
5		Command details AID 150 [0x96] Byte 5	"Ramp Down" must be set to a value. 0-250 [0x00-FA] = Stop ramp time 0.05 s/bit 251 [0xFB] = Default speed set via Actuator Connect 252-255 [0xFC-FF] = Reserved
6		Command details AID 150 [0x96] Byte 0-1	"Position" must be set to = 64257 [0xFB01] for 'Run out'.
7**	R	Feedback status details AID 100 [0x64] Byte 3	"Status Flags" bit 3 and bit 1 change to 1 to indicate that: Bit 3 = Actuator is running out Bit 1 = Endstop reached signal out

* AID 100 = Feedback / AID 150 = Command

** Optional

Run the actuator to target position (150 mm)

Step	Read/ Write	Assembly Instance ID*	Action
1		-	Check that general run prerequisites are fulfilled.
2	W	Command details AID 150 [0x96] Byte 2	"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 details AID 150 [0x96] Byte 3	"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 details AID 150 [0x96] Byte 4	"Ramp Up" must be set to a value. 0-250 [0x00-FA] = Start ramp time 0.05 s/bit 251 [0xFB] = Default speed set via Actuator Connect 252-255 [0xFC-FF] = Reserved
5		Command details AID 150 [0x96] Byte 5	"Ramp Down" must be set to a value. 0-250 [0x00-FA] = Stop ramp time 0.05 s/bit 251 [0xFB] = Default speed set via Actuator Connect 252-255 [0xFC-FF] = Reserved
6		Command details AID 150 [0x96] Byte 0-1	"Position" must be set to = 1500 [0x05DC] for 'Run to Target Position 150 mm'.
7**	R	Feedback status details AID 100 [0x64] Byte 3	"Status Flags" bit 3 or bit 4 change to 1 to indicate that: Bit 3 = Actuator is running out Bit 4 = Actuator is running in

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	Assembly Instance ID*	Action
1	R	Feedback status details AID 100 [0x64] Byte 3	Confirm that "Status Flags" bit 2 is = 1 for 'Overcurrent'
2	W	Command details AID 150 [0x96] Byte 0-1	"Position" must be set to = 64259 to send a 'Stop' command
3	W	Command details AID 150 [0x96] Byte 0-1	"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'
4**	R	Feedback status details AID 100 [0x64] Byte 3	"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

* AID 100 = Feedback / AID 150 = Command
** Optional

Clear error

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

Step	Read/ Write	Assembly Data***	Action
1	R	ADI Byte 4	Confirm that "Error Code" is not = 0
2	W	ADO Byte 0-1	"Position" set to = 64256 (Clear Error Codes)
3	R	ADI Byte 4	Confirm that "Error Code" is = 0 If "Error Code" is not = 0, then correct the error in the system and repeat step 2.

***ADI = Assembly Data In / ADO = Assembly Data Out

Implicit messaging

EtherNet/IP process data refers to real-time, cyclic data exchanged between industrial control devices for automation tasks, and configuration data for setting up and managing these devices.

This data is organised using the Common Industrial Protocol (CIP) and transported within TCP/IP packets, enabling communication for both time-critical operations (implicit messaging) and diagnostics or parameter uploads (explicit messaging).

Assembly Data Output (Command)

Command **Assembly Instance ID 150** Class 1 Implicit I/O messaging					
Byte 5 [MSB]	**Byte 4**	**Byte 3**	**Byte 2**	**Byte 1**	**Byte 0 [LSB]**
Ramp Down	Ramp Up	Speed	Current Limit	Position	

Assembly Instance ID 150					
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 Code (See Assembly Data in Byte 4)	
			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	Current Limit	UINT8	0–250	Maximum current limit	0.25 A/bit
			251	Default current limit	
			252–255	Invalid value Actuator will not run	
Byte 3	Speed	UINT8	0–200	Speed	0.5%/bit
			201–250	100% speed	
			251	Default speed	
			252–255	Invalid value Actuator will not run	
Byte 4	Ramp Up	UINT8	0–250	Ramp up time	0.05 s/bit
			251	Default ramp up time	
			252–255	Invalid value Actuator will not run	
Byte 5	Ramp Down	UINT8	0–250	Ramp down time	0.05 s/bit
			251	Default ramp down time	
			252–255	Invalid value Actuator will not run	

Assembly Data Input (Feedback)

Feedback Assembly Instance ID 100 Class 1 Implicit I/O messaging							
Byte 7 [MSB]	**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	

Assembly Instance ID 100					
Byte(s)	**Status**	**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	Current Draw	UINT8	0	Not running	0.25 A/bit
			1-250	Motor current draw	
			251-253	Reserved	
			254	Fault in current measurement circuit	
			255	Reserved	
Byte 3	Status Flags	UINT8	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	
Byte 4	Error Code*	UINT8	0	No error detected	8-bit error code showing the currently 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	
			8	Motor controller	
			9	Internal power supply	
			10	Internal current measurement	

* See Error Code descriptions in section: Error codes

Assembly Data Input (Feedback)

Assembly Instance ID 100					
Byte(s)	**Status**	**Data type**	**Details**	**Description**	**Scaling**
Byte 4	Error Code*	UINT8	11	Parallel arbitration	8-bit error code showing the currently active error with the highest priority only
			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 5-6	Speed	UINT16	0-4015	Speed of actuator	0.1 mm/s / bit
			4016-65535	Reserved	
Byte 7	AUX Inputs	UINT8	b0-b1	Input 1 level	1 bit/ 25% VCC
			b2-b3	Input 2 level	
			b4-b7	Reserved	

* See Error Code descriptions in section: Error codes

Assembly Data Input (Parallel Feedback)

Parallel Feedback Assembly Instance ID 100 Class 1 Implicit I/O messaging					
Byte 13 [MSB]	**Byte 12**	**Byte 11**	**Byte 10**	**Byte 9**	**Byte 8**
Parallel Status Flags	Parallel Error Code	Parallel Error Source			

Assembly Instance ID 100					
Byte(s)	**Command**	**Data type**	**Details**	**Description**	**Unit**
Byte 8-11	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 12	Parallel Error Code*	UINT8	0	No error detected	8-bit error code indicating the currently 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	
			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 13	Parallel Status Flags	UINT8	b0	Parallel endstop reached out	Bit-independent status indicators
			b1	Parallel endstop reached in	
			b2	Parallel running outside nominal conditions	
			b3-b7	Reserved. Always high	

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

Explicit messaging

EtherNet/IP explicit messaging is a client-server communication method using TCP/IP that allows an originator (client) to request specific data or services from a target device (server) for non-time-critical operations like configuration, diagnostics, or register reads/writes.

Each request contains explicit instructions for the target device to decode and respond to, making it less efficient but highly flexible for accessing individual data points on demand

These parameters are addressed by a combination of Class, Instance, and Attribute.

To read a parameter Read Attribute Single (0x0E) must be used. To write a parameter Write Attribute Single (0x10) must be used. For Class ID, Parameter object (0x0F) must be used. Attribute ID is 1 for all instance IDs in this section.

Configuration

Configuration **Assembly Instance ID 151** Class 3 Explicit Messaging						
Instance ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**Access**
1	Current Limit - Outwards	UINT8	0-255	No error detected	0.25 A/bit	R/W
				IP address of the actuator with highest priority error		
2	Current Limit - Inwards			No error detected		
3	Ramp Up - Outwards	UINT16	0-65535	Works only when AID 150 “Ramp Up” is 251	1 ms/bit	R/W
4	Ramp Up - Inwards					
5	Ramp Down - Outwards			Works only when AID 150 “Ramp Down” is 251		
6	Ramp Down - Inwards					
7	Maximum Speed	UINT8	0-200	Overrules AID 150 “Speed”	0.5% /bit	R/W
			201-255		100%	
8	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	
9	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 **Assembly Instance ID 151** Class 3 Explicit Messaging						
Instance ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**Access**
10	UIN	UINT32		Unique 8-digit identification number		R
11	Variant	UINT32		SW**xxxxxxx**Vx-x		R
12	Version Major			SWxxxxxxxV**x**-x		
13	Version Minor			SWxxxxxxxVx-**x**		
14	Config Production Order Number	UINT32		Unique 8-digit identification number		R
15	Production Date			yyyymmdd		
16	Max. Current Seen	UINT8		0.25 A/bit		
17	Max. FET Temperature Seen			1°C /bit - 40°C		
18	Max. Ambient Temperature Seen					
19	Min. Ambient Temperature Seen					
20	Total Current Usage	UINT32		1 (Ampere*seconds)/bit		
21	Total Runtime			1 s/bit		
Number of stops due to						
22	Overvoltage	UINT8		Number of stops		R
23	FET Over-temperature					
24	Ambient Over-Temperature					
25	Undervoltage					
26	Hall Error					
27	Endstop Switch Error					
28	Default Current Limit Overloads - Out					
29	Default Current Limit Overloads - In					

Diagnostics

Diagnostics Assembly Instance ID 151 Class 3 Explicit Messaging						
Instance ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**Access**
Number of resettable stops due to						
30	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
31	Custom Current Limit Overloads - In					
Number of						
32	Communication Errors	UINT16		Number of		R
33	Endstop Reached - Out	UINT32				
34	Endstop Reached - In					
35	Starts - Out					
36	Starts - In					
37	Total Piston Distance Traveled	UINT32		5 m/bit		R
Reason for last stop – ID 0: See Reason for last stop definitions in section below						
38	Reason	UINT16		Reason for stop		R
39	Count	UINT8		Number of stops in a row		
40	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						
41	Reason	UINT16		Reason for stop		R
42	Count	UINT8		Number of stops in a row		
43	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						
44	Reason	UINT16		Reason for stop		R
45	Count	UINT8		Number of stops in a row		
46	Powered Time	UINT32		Powered time when the last stop occurred	1 s/bit	

Diagnostics

Diagnostics Assembly Instance ID 151 Class 3 Explicit Messaging						
Instance ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**Access**
Reason for last stop – ID 3: See Reason for last stop definitions in section below						
47	Reason	UINT16		Reason for stop		R
48	Count	UINT8		Number of stops in a row		
49	Powered Time	UINT32		Powered time when the last stop occurred	1 s/bit	
Reason for last stop – ID 4: See Reason for last stop definitions in section below						
50	Reason	UINT16		Reason for stop		R
51	Count	UINT8		Number of stops in a row		
52	Powered Time	UINT32		Powered time when the last stop occurred	1 s/bit	
53	Total Corrected Distance	UINT32		1 mm/bit		R
54	FET Temperature	UINT8		1°C /bit - 40°C		
55	Ambient Temperature					
56	Number of Hall Shifts at Learn	UINT16		0.1 mm/bit		
57	Zero Point Offset at Learn					
58	Production Order Number	UINT32		Unique 8-digit identification number		
LINAK Special Functions						
59	Functions	UINT8	0	Reserved		R
			1	Restart actuator		
			2-255	Reserved		
IP Address in Parallel System						
60	Address 1	UINT32		Sorted in descending order		
61	Address 2					
62	Address 3					
63	Address 4					
64	Address 5					
65	Address 6					
66	Address 7					
67	Address 8					

Diagnostics

Diagnostics **Assembly Instance ID 151** Class 3 Explicit Messaging						
Instance ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**Access**
68	Powered Time	UINT32		1 s/bit		R
69	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.

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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