WE IMPROVE YOUR LIFE

EtherNet/IP™
# User Manual

EtherNet/IP®

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# 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.

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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 3

| | |
|---|---|
| LA14 and LA25 removed | Page 6 |
| LA33 added | Page 6 |
| Information about separate supplies added | Page 10 |
| Adapter settings updated | Page 13 |
| 'Command examples' section updated | Page 14-16 |
| 'Assembly data' section added | Page 17-20 |

## Edition 2

| | |
|---|---|
| Item number for cable kit added | Page 6-7 |
| 'Manual run' changed to 'Extends actuator' and 'Retracts actuator' | Page 6-8 |
| 'Service interface' changed to 'Parallel communication' | Page 6-8 |
| 'Service interface GND' changed to 'Parallel GND' | Page 6-8 |
| 'V DC' added | Page 6-8 |
| Information about separate supplies added | Page 6-8 |
| 'Parallel' section updated | Page 9-10 |
| Power supply table updated | Page 11 |
| 'Parameters to be verified by Actuator Connect™' updated | Page 12 |
| 'Run out command' changed to 'Command examples' | Page 14 |
| 'Communication sequence...' changed to 'Run the actuator outwards' | Page 14 |

## Edition 1

New document

# Connection diagram

Applicable for: LA33, LA36, LA37, LA76 and LA77
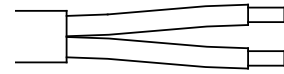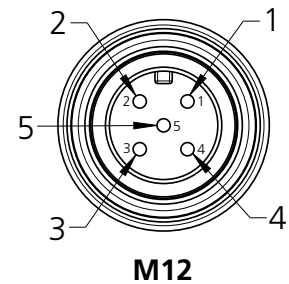
| BROWN | 24/48 V DC |
| BLUE | GND |

| 1 | Extends the actuator |
| 2 | Retracts the actuator |
| 4* | Split power supply V DC |
| 3 | Parallel data |
| 5 | Parallel GND |

**M12**

| 1 | ETH_TX+ |
| 2 | ETH_RX+ |
| 3 | ETH_TX- |
| 4 | ETH_RX- |
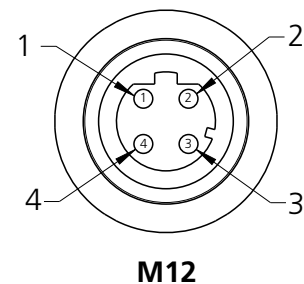
**M12**

ⓘ 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.

* Split power supply and motor supply (Brown), which refer to a common GND (Blue).

This approach is used to maintain power on the intelligent part of the actuator. In case the main supply is disconnected, split power supply allows e.g. that the position is maintained. The main supply may be disconnected for reasons related to safety, maintenance or installation.

👆 **Actuator Connect™ is available for EtherNet/IP™ actuators and can be used for:**

Diagnostics, manual run and configuration. The newest version is available online here.

ⓘ Connect the actuator to Actuator Connect via a USB adapter cable (must be purchased separately) to enable and configure various features.

Item number for cable kit: 0367996
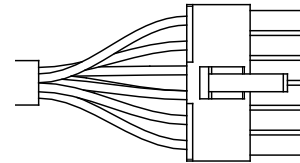
# Connection diagram

Applicable for: LC3 IC

| | |
|---|---|
| **BROWN** | 24/48 V DC |
| **BLUE** | GND |

| | |
|---|---|
| **RED** | Extends the actuator |
| **BLACK** | Retracts the actuator |
| **ORANGE*** | Split power supply V DC |
| **VIOLET** | Parallel data |
| **WHITE** | Parallel GND |

**Molex mini-fit 12-pin**

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

8        1
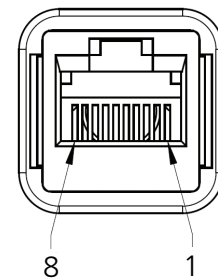
**RJ45**

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. The wiring conforms to the T-568A standard.

* Split power supply and motor supply (Brown), which refer to a common GND (Blue).

This approach is used to maintain power on the intelligent part of the actuator. In case the main supply is disconnected, split power supply allows e.g. that the position is maintained. The main supply may be disconnected for reasons related to safety, maintenance or installation.

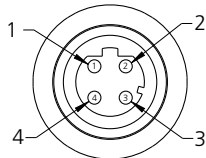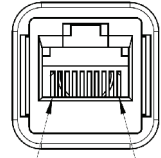**Actuator Connect™ is available for EtherNet/IP™ actuators and can be used for:**

Diagnostics, manual run and configuration. The newest version is available online here.

Connect the actuator to Actuator Connect via a USB adapter cable (must be purchased separately) to enable and configure various features.

Item number for cable kit: 0367996

# I/O specifications

| Input/Output | Specification | Comments |
|---|---|---|
| Description | The communication protocol conforms to the IEEE 802.3-2018 Ethernet standard with communication speeds of 10 Mbps and 100 Mbps. | **EtherNet/IP**® |
| Brown | Connect Brown to positive<br><br>24/48 V DC | Note:<br><br>Do not change the power supply polarity on the Brown and Blue wires! |
| Blue | Connect Blue to negative<br><br>GND | Only for powering the motor driver module.<br><br>Power supply GND is electrically connected to the housing through a capacitor and resistor in parallel. |
| **PIN out** | **Data cable M12 - 5-pin male** | |
| Pin 1 | Extends the actuator | The signal becomes active at:<br><br>$V_{IN} > 67\%$ of V DC<br><br>The signal becomes inactive at: |
| Pin 2 | Retracts the actuator | $V_{IN} < 33\%$ of V DC<br><br>Input current: 10 mA |
| Pin 4 | Split power supply V DC | Split power supply:<br><br>24 V DC with ≈28 mA current consumption.<br>48 V DC with ≈16 mA current consumption.<br><br>The split power supply uses the common GND from the power supply (Blue).<br><br>Split power supply is only for powering the communication of the integrated controller. |
| Pin 3 | Parallel data | The Parallel drive function will support up to 8 actuators running simultaneously.<br><br>It is possible to run Parallel with a main power supply or separate power supplies. |
| Pin 5 | Parallel GND | If separate supplies are used, they must have the same potential, and the power supply GND (Blue wires) must be connected in the common ground. |
| **PIN in** | **Data cable M12 - 4-pin female** | |
| Pin 1 | ETH_TX+ | |
| Pin 2 | ETH_RX+ | |
| Pin 3 | ETH_TX- | |
| Pin 4 | ETH_RX- | |
| **PIN in** | **RJ45 (Only for LC3 IC)** | |
| Pin 1 | ETH_TX+ | |
| Pin 3 | ETH_RX+ | |
| Pin 2 | ETH_TX- | |
| Pin 6 | ETH_RX- | |

# 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 | The system can be designed with either one main power supply or it can be supplied by individual supplies corresponding to the number of actuators in the system. Please respect actuator specifications regarding voltage level and current consumption! Make sure that the power supplies have a common GND and the same potential. |

## Option 1 - A simple parallel setup
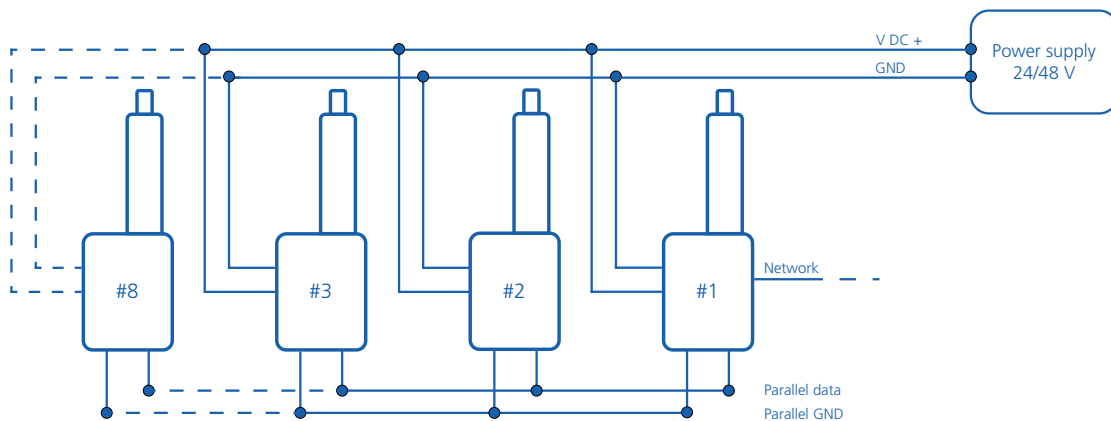


In a simple parallel setup there is only one actuator connected to the network. This actuator receives run commands and shares data with the controller. The remaining actuators in the system are only connected to internal parallel communication. This way, the internal communication ensures that the system 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.

# Parallel

## Option 2 - Bus communication on all actuators
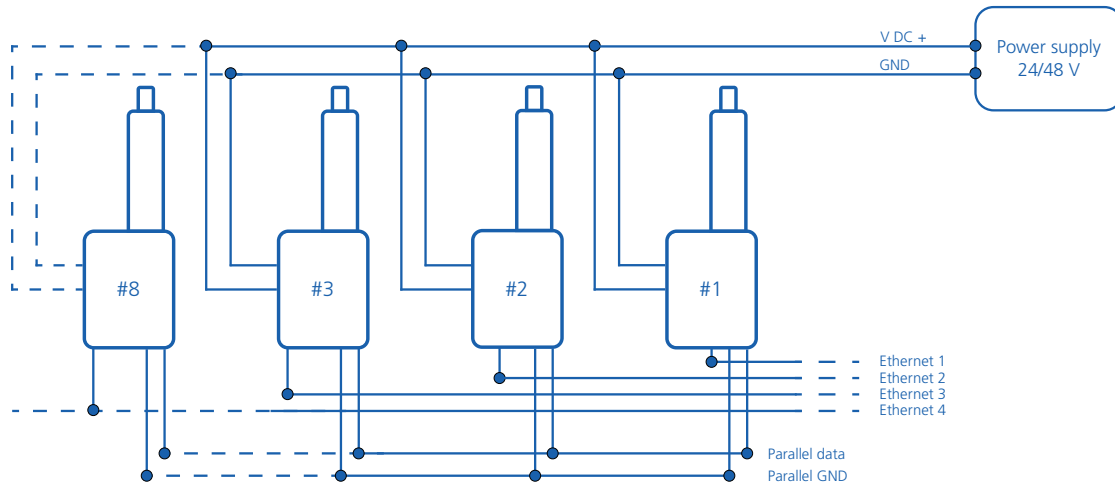


If there is a need for e.g. monitoring the real-time data of each actuator, it is possible to connect all actuators as nodes to the network. This will provide comprehensive usage data, which can be used to enhance performance in the application. Similar to option 1, this requires that all actuators are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

## Power supply

EtherNet/IP 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 |
| | 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 a 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 LA33, LA36, LA37, LA76 and LA77:**

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 flying leads, and the USB connector must be inserted into your PC.
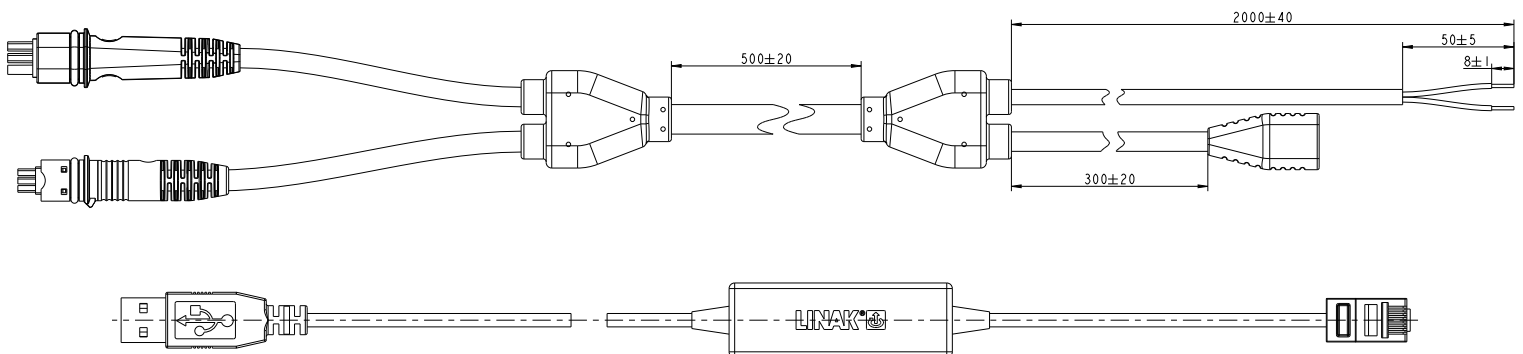


For more information about wiring/connector, please see the connection diagram.

## Parameters to be verified by Actuator Connect™

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

# Adapter settings

Depending on controller (Scanner) there are different ways to configure the adapter settings (Actuator). Some may accept EDS files, and others will need you to input the values manually. EDS file is downloadable at www.LINAK.com

## Setting up the scanner for adapter manually

Follow the example on the next page to complete the startup procedures necessary for successful communication with a LA36 EtherNet/IP™. Output and Input Assembly are run by Implicit commands, while Configuration Assembly and Diagnostics are run by Explicit commands.

All necessary adapter settings written in the table below can be found in the EDS file.

| Adapter Settings (Startup Procedures) | | |
|---|---|---|
| **Parameters** | **Value** | **Description** |
| Adapter IP address | 192.168.1.10 | IP address of the actuator |
| Vendor ID | 1538 | LINAK |
| Product Type | 12 | Communication adapter |
| Product Code | 36 | LA36  (Adjust value according to your product) |
| Major Revision | 1 | Revision of adapter |
| Minor Revision | 4 | Revision of adapter |
| RPI (Requested Packet Interval) | 100 ms | Update rate |
| Configuration AssemblyID | 151 [0x97] | ID for configuration data |
| Configuration Assembly Size | 0 | Length of configuration data in bytes (None in this example) |
| O->T (Output) AssemblyID | 150 [0x96] | ID for Output Assembly data |
| O->T (Output) Assembly Size | 6 | Length of Output Assembly data in bytes |
| T->O (Input) AssemblyID | 100 [0x64] | ID for Input Assembly data |
| T->O (Input) Assembly Size | 14 | Length of Input Assembly data in bytes |

O->T Organizer to Target
T->O Target to Organizer

When the Scanner is configured with the above values, communication should be established. You should now be able to access the "Command details" from AssemblyID 150 (0x96) and "Feedback details" from AssemblyID 100 (0x64).

⚠ 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 | Write | Command details AID 150 [0x96] 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 | Write | Feedback status details AID 100 [0x64] Byte 4 | "Error Code" must be = 0 [0x00]. |
| 3 | Write | Feedback status details AID 100 [0x64] Byte 3 | "Status Flags" bit 2 (Overcurrent) must be = 0. |
| 4 | Write | Feedback status details AID 100 [0x64] Byte 3 | "Status Flags" bit 5 (Heartbeat needed) must be = 0. |
| 5 | Write | Feedback status details AID 100 [0x64] Byte 3 | "Status Flags" bit 6 (Actuator is running outside normal 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 | Write | 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 | Write | 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 | Write | Command details AID 150 [0x96] Byte 4 | "Soft Start" 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 | Write | Command details AID 150 [0x96] Byte 5 | "Soft Stop" 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 | Write | Command details AID 150 [0x96] Byte 0 Byte 1 | "Position" must be set to = 64257 [0xFB01] for 'Run out'. |
| 7** | Read | 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 | Write | 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 | Write | 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 | Write | Command details AID 150 [0x96] Byte 4 | "Soft Start" 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 | Write | Command details AID 150 [0x96] Byte 5 | "Soft Stop" 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 | Write | Command details AID 150 [0x96] Byte 0 Byte 1 | "Position" must be set to = 1500 [0x05DC] for 'Run to Target Position 150 mm'. |
| 7** | Read | 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 |

## Clear error in overcurrent situation

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 | Read | Feedback status details AID 100 [0x64] Byte 3 | Confirm that "Status Flags" bit 2 is = 1 for 'Overcurrent' |
| 2 | Write | Command details AID 150 [0x96] Byte 0 Byte 1 | "Position" must be set to run in the opposite direction of the blockage<br>Set to = 64257 [0xFB01] for 'Run out'<br>or<br>Set to = 64258 [0xFB02] for 'Run in' |
| 3 | Read | Feedback status details AID 100 [0x64] Byte 3 | "Status Flags" bits change to 1 to indicate that either:<br>Bit 3 = Actuator is running out<br>Bit 4 = Actuator is running in<br>Bit 1 = Endstop reached out<br>Bit 0 = Endstop reached in |

\* AID 100 = Feedback / AID 150 = Command

\*\* Optional

## Assembly data

When controlling the actuator from the EtherNet/IP controller, it is important to understand the input and output data. For EtherNet/IP this is defined by the EDS file. The specific data is described in the tables below.

## Assembly Data Output

| Output Assembly Instance ID150 [0x96]<br>Class 1 implicit I/O messaging | | | | | |
|---|---|---|---|---|---|
| Byte 5 [MSB] | Byte 4 | Byte 3 | Byte 2 | Byte 1 | Byte 0 [LSB] |
| Soft Stop | Soft Start | Speed | Current | Position | |

| Assembly Instance ID | Byte(s) | Command | Data type | Details | Description | Scaling |
|---|---|---|---|---|---|---|
| 150 [0x96] | Byte 0 Byte 1 | Position | UINT16 | 0–64255 [0x0000-FAFF] | Run to position | 0.1 mm/bit |
| | | | | 64256 [0xFB00] | Clear Error Codes (see AID 100 [0x64] Byte 4) | |
| | | | | 64257 [0xFB01] | Run out | |
| | | | | 64258 [0xFB02] | Run in | |
| | | | | 64259 [0xFB03] | Stop | |
| | | | | 64260 [0xFB04] | Recovery run out | |
| | | | | 64261 [0xFB05] | Recovery run in | |
| | | | | 64262–65535 [0xFB06-FFFF] | Invalid value, actuator will not run | |
| | Byte 2 | Current | UINT8 | 0–250 [0x00-FA] | Maximum current limit | 0.25 A/bit |
| | | | | 251 [0xFB] | Use default current value | |
| | | | | 252–255 [0xFC-FF] | Invalid value, actuator will not run | |
| | Byte 3 | Speed | UINT8 | 0–200 [0x00-C8] | Speed | 0.5%/bit |
| | | | | 201–250 [0xC9-FA] | Use 100% speed | |
| | | | | 251 [0xFB] | Use default speed value | |
| | | | | 252–255 [0xFC-FF] | Invalid value, actuator will not run | |

## Assembly Data Output

| Assembly Instance ID | Byte(s) | Command | Data type | Details | Description | Scaling |
|---|---|---|---|---|---|---|
| 150 [0x96] | Byte 4 | Soft Start | UINT8 | 0–250 [0x00-FA] | Start ramping time | 0.05 s/bit |
| | | | | 251 [0xFB] | Use default soft start value | |
| | | | | 252–255 [0xFC-FF] | Invalid value, actuator will not run | |
| | Byte 5 | Soft Stop | UINT8 | 0–250 [0x00-FA] | Stop ramping time | 0.05 s/bit |
| | | | | 251 [0xFB] | Use default soft stop value | |
| | | | | 252–255 [0xFC-FF] | Invalid value, actuator will not run | |

## Assembly Data Input

| Input Assembly Instance ID100 [0x64] Class 1 implicit I/O messaging | | | | | | | |
|---|---|---|---|---|---|---|---|
| Byte 7 | Byte 6 | Byte 5 | Byte 4 | Byte 3 | Byte 2 | Byte 1 | Byte 0 [LSB] |
| AUX Input | Speed | | Error Code | Status Flags | Current | Position | |

| Assembly Instance ID | Byte(s) | Status | Data type | Details | Description | Scaling |
|---|---|---|---|---|---|---|
| 100 [0x64] | Byte 0 Byte 1 | Position | UINT16 | 0–64255 [0x0000-FAFF] | Position of the actuator piston | 0.1 mm/bit |
| | | | | 64256-65023 [0xFB00-FDFF] | Reserved | |
| | | | | 65024 [0xFE00] | Position lost | |
| | | | | 65025-65535 [0xFE01-FFFF] | Reserved | |
| | Byte 2 | Current | UINT8 | 0 [0x00] | Not running | 0.25 A/bit |
| | | | | 1-250 [0x00-FA] | Measured motor current | |
| | | | | 251-253 [0xFB-FD] | Reserved | |
| | | | | 254 [0xFE] | Fault in current measurement circuit | |
| | | | | 255 [0xFF] | Reserved | |

## Assembly Data Input

| Assembly Instance ID | Byte(s) | Status | Data type | Details | Description | Scaling |
|---|---|---|---|---|---|---|
| 100 [0x64] | Byte 3 | Status Flags | UINT8 | b0 | Endstop reached in | 8-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 [0x00] | No error detected | 8-bit error code showing the currently active error with the highest priority only |
| | | | | 1 [0x01] | 'Run' command overruled | |
| | | | | 2 [0x02] | Position sensor | |
| | | | | 3 [0x03] | Overvoltage | |
| | | | | 4 [0x04] | Undervoltage | |
| | | | | 5 [0x05] | Communication sync. | |
| | | | | 6 [0x06] | Endstop switch | |
| | | | | 7 [0x07] | Temperature | |
| | | | | 8 [0x08] | Motor controller | |
| | | | | 9 [0x09] | Internal power supply | |
| | | | | 10 [0x0A] | Internal current measurement | |
| | | | | 11 [0x0B] | Parallel arbitration | |
| | | | | 12 [0x0C] | Position not changing | |
| | | | | 13 [0x0D] | Position initialisation not possible | |
| | | | | 14 [0x0E] | Alone in parallel system | |
| | | | | 15 [0x0F] | Incorrect number in parallel system | |

## Assembly Data Input

| Assembly Instance ID | Byte(s) | Status | Data type | Details | Description | Scaling |
|---|---|---|---|---|---|---|
| 100 [0x64] | Byte 4 | Error Code | UINT8 | 254 [0xFE] | Other internal error (Not specified) | 8-bit error code showing the currently active error with the highest priority only |
| | | | | 255 [0xFF] | Other external error (Not specified) | |
| | Byte 5 Byte 6 | Speed | UINT16 | 0-4015 [0x0000-0FAF] | Speed of actuator piston | 0.1 mm/s / bit |
| | | | | 4016-65535 [0x0FB0-FFFF] | Reserved | |
| | Byte 7 | AUX Input | UINT8 | b0-b1 | Input 1 level | 25% VCC / bit |
| | | | | b2-b3 | Input 2 level | |
| | | | | b4-b5 | Reserved | |
| | | | | b6-b7 | Reserved | Always high |

## Assembly Data Input (Parallel feedback)

| Input Assembly Instance ID100 [0x64] Class 1 implicit I/O messaging Only for parallel feedback | | | | | |
|---|---|---|---|---|---|
| Byte 13 [MSB] | Byte 12 | Byte 11 | Byte 10 | Byte 9 | Byte 8 |
| Status Flags | Error Group | Error Source | | | |

| Assembly Instance ID | Byte(s) | Command | Data type | Details | Description | Unit |
|---|---|---|---|---|---|---|
| 100 [0x64] | Byte 8 Byte 9 Byte 10 Byte 11 | Error Source | UINT32 | 0 [0x00000000] | No error is active on any actuator in parallel system, or error source ID is irrelevant ("Parallel start-up" error is reported by an actuator still connected to the system) | 32-bit IP address |
| | | | | 1-4294967295 [0x00000001-FFFFFFFF] | IP address of the actuator with highest priority error | |

## Assembly Data Input (Parallel feedback)

| Assembly Instance ID | Byte(s) | Status | Data type | Details | Description | Unit |
|---|---|---|---|---|---|---|
| 100 [0x64] | Byte 12 | Error Group | UINT8 | 0 [0x00] | No error detected | 8-bit error code indicating the currently active error of highest priority on any actuator in the parallel system |
| | | | | 1 [0x01] | Current overload | |
| | | | | 2 [0x02] | Hardware | |
| | | | | 3 [0x03] | Temperature | |
| | | | | 4 [0x04] | Overvoltage | |
| | | | | 5 [0x05] | Undervoltage | |
| | | | | 6 [0x06] | Analogue input out of range error (N/A for bus interfaces) | |
| | | | | 7 [0x07] | Position not changing | |
| | | | | 8 [0x08] | Run signal overruled | |
| | | | | 9 [0x09] | Position initialisation not possible | |
| | | | | 10 [0x0A] | Parallel start-up | |
| | | | | 11 [0x0B] | Parallel running | |
| | | | | 12 [0x0C] | BLDC motor | |
| | | | | 13 [0x0D] | Endstop switch | |
| | | | | 14 [0x0E] | Parallel communication | |
| | | | | 15 [0x0F] | Parallel setup stopped | |
| | | | | 24 [0x18] | Other error | |
| | | | | 25 [0x19] | Position lost | |
| | Byte 13 | Status Flags | UINT8 | b0 | Parallel endstop reached out | 8-bit independent status indicators |
| | | | | b1 | Parallel endstop reached in | |
| | | | | b2 | Parallel running outside nominal conditions | |
| | | | | b3-b7 | Reserved | |

# Error codes

| Error | Description |
|---|---|
| 0 | **No error detected**<br>No LINAK defined error detected |
| 1 | **'Run' command overruled**<br>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**<br>Position sensors are outside of expected operating range. VCC motor OK.<br>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**<br>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**<br>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. |
| 5 | **Communication sync**<br>Heartbeat from the master is not within the expected heartbeat interval. Consult the documentation for minimum requirements for heartbeat interval. |
| 6 | **Endstop switch (N/A for bus interfaces)**<br>Endstop switches are behaving unexpectedly.<br>Example: Both endstop switches have been activated simultaneously for more than 100 ms. Perform the initialization process by running the actuator fully extended and retracted. |
| 7 | **Temperature**<br>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 | **Motor controller**<br>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**<br>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**<br>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**<br>Start-up parallel configuration procedure in progress. |

# Error codes

| Error | Description |
|-------|-------------|
| 12 | **Position not changing** <br> 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** <br> Internal initialisation parameters missing. Contact LINAK. |
| 14 | **Alone in parallel system** <br> Incorrect number of actuators in parallel system. |
| 15 | **Incorrect number in parallel system** <br> Incorrect number of actuators in parallel system or wrongly configured |
| 254 | **Other internal error (Not specified)** <br> 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)** <br> Unspecified external hardware/software error. Please inspect your application for possible issues. Send 'Clear error' command to clear error. |

# Parallel error codes

| Error | Description |
|-------|-------------|
| 0 | **No error detected** <br> No LINAK defined error detected |
| 1 | **Current overload** <br> Current draw is above allowed operating limit. Reduce load, send a 'Clear error' command, and run the actuator in the opposite direction. |
| 2 | **Hardware** <br> Internal hardware error. Send 'Clear error' command to clear error. If the error persists, contact LINAK or replace the product. |
| 3 | **Temperature** <br> 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** <br> 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** <br> 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. |

# Parallel error codes

| Error | Description |
|---|---|
| 6 | **Analogue input out of range (N/A for bus interfaces)** |
|  | 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 | **Run signal overruled** |
|  | 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. |
| 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 (N/A for bus interfaces)** |
|  | Endstop switches are behaving unexpectedly. Both endstop switches have been activated simultaneously for more than 100 ms. Perform the initialization 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** |
|  | Follow the relevant initialisation procedures by running the actuators from fully retracted to fully extended. If the error persists, contact LINAK or replace the product. |

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