CAN SAE J1939

User Manual

CAN | J1939

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.

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About LINAK® CAN bus actuators

LINAK TECHLINE® CAN bus actuators are primarily designed with focus on mobile agriculture and industrial automation. The communication protocol relies on the SAE J1939 standard. The contents of this document assume that the reader is familiar with the SAE J1939 standard.

In addition to full position control, the CAN bus actuator is able to provide feedback information about the piston position, service data, and full diagnostics. It also provides system identification data and actual current at runtime.

CAN bus specifications

This section describes the requirements of the CAN bus hardware and software interface:

The physical layer is in accordance with J1939-15	
Speed	50, 100, 125, 250, 500 or Auto kbps (changeable in Actuator Connect™ or BusLink)
Max. bus length	40 metres
Max. stub length	3 metres
Max. node count	10 (30*)
Wiring	Unshielded twisted pair
Cable impedance	120 Ω (±10%)

The maximum cable length delivered by LINAK is no longer than 3 metres. Consequently, all system tests carried out are limited to consist of 3-meter cables. Non-error tolerant physical layer with the following specifications: Low-power mode is according to ISO 11898-5.

Standards

The following standards and revisions are the bases of the LINAK TECHLINE CAN bus software:

SAE J1939-21 DEC2010	Data Link Layer
SAE J1939-31 APR2014	Network Layer
SAE J1939-71 APR2014	Application Layer
SAE J1939-73 JUL2013	Application Layer - Diagnostics DM14 (Memory access request) DM15 (Memory access response) DM16 (Binary data transfer)
SAE J1939-81 JUN 2011	Network Management
SAE J1939-82 AUG 2008	Compliance - Truck and bus (Complies with the relevant parts of the SAE J1939-82)

* The SAE J1939-15 can accept up to 30 nodes. See section 3.1 of J1939-15 May 2014 for details.

Connection diagram

6- and 8-pin

Applicable for: LA14, LA25, LA33, LA36, and LA37

BROWN	12/24/48 V DC
BLUE	GND
RED	Extends the actuator HW Addressing pin 2
BLACK	Retracts the actuator HW Addressing pin 1
YELLOW	CAN_H
GREEN	CAN_L
VIOLET	Not to be connected
WHITE	HW Addressing pin 3

For more information, see the Connection overview.

I/O specifications

6- and 8-pin

Input/Output	Specification		Comments	
Description	CAN bus is compatible with the SAE J1939 standard. Uses CAN messages to command movement, setting parametres and to deliver feedback from the actuator. Actuator identification is provided, using hardware and software addressing.		CAN J1939	
Brown	12/24/48* V DC *48 V only for LA36 and LA37		Note: Do not swap the power supply polarity on the Brown and Blue wires! The PCB is coupled to the housing through a capacitor.	
Blue	GND For more information, see the section 'Power supply'			
Red	Extends the actuator / Hardware addressing (2)	The signal becomes active at: > 67% of V_{IN} The signal becomes inactive at: < 33% of V_{IN} Input current: 10 mA	Manual run: If not connected to VCC at startup:	Hardware addressing: When used for Hardware addressing, connect to VCC or open/GND.
Black	Retracts the actuator / Hardware addressing (1)			
Yellow	CAN_H		Actuators with CAN bus do not contain the 120 Ω terminal resistor. The physical layer is in accordance with J1939-15.* Speed: Autobaud up to 500 kbps (CAN bus prior to version 3.0 up to 250 kbps) Wiring: Unshielded twisted pair	
Green	CAN_L			
Violet	Not to be connected			
White	HW Addressing (3)		Hardware addressing: When used for Hardware addressing, connect to VCC or open/GND.	

* J1939-15 refers to twisted pair and shielded cables.
The standard/default cables delivered with CAN actuators do not comply with this.

Connection diagram

9- and 12-pin

Applicable for: LA14, LA25, LA21, LA33, LA36, LA37, LA73, LA76, LA77 and LC3 IC

BROWN	24/48 V DC
BLUE	GND
ORANGE	Split power supply V DC
RED	Extends the actuator HW Addressing pin 2
BLACK	Retracts the actuator HW Addressing pin 1
LIGHT BLUE	HW Addressing pin 3
YELLOW	CAN_H
GREEN	CAN_L
VIOLET	Parallel data +
WHITE	Parallel data -
GREY	Not to be connected

LA14 and LA25 (12-pin) only available with flying leads. Connections (Deutsch and AMP) only valid for 9-pin.

For more information, see the Connection overview.

I/O specifications

9- and 12-pin

Input/Output	Specification		Comments	
Description	CAN bus is compatible with the SAE J1939 standard. Uses CAN messages to command movement, setting parametres and to deliver feedback from the actuator. Actuator identification is provided, using hardware and software addressing.		CAN J1939	
Brown	24/48 V DC		Note: Do not swap the power supply polarity on the Brown and Blue wires! The PCB is coupled to the housing through a capacitor.	
Blue	GND For more information, see the section 'Power supply'			
Orange	Split power supply V DC		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.	
Red	Extends the actuator / Hardware Addressing (2)	The signal becomes active at: > 67% of V_{IN} The signal becomes inactive at: < 33% of V_{IN} Input current: 10 mA	Manual run: If not connected to VCC at startup:	Hardware addressing: When used for Hardware addressing, connect to VCC or open/GND.
Black	Retracts the actuator / Hardware Addressing (1)			
Light Blue	Hardware Addressing (3)		When used for Hardware addressing, connect to VCC or open/GND.	
Yellow	CAN_H		Actuators with CAN bus do not contain the 120 Ω terminal resistor. The physical layer is in accordance with J1939-15.* Speed: Autobaud up to 500 kbps (CAN bus prior to version 3.0 up to 250 kbps) Wiring: Unshielded twisted pair	
Green	CAN_L			
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.	
White	Parallel data -			
Grey	Not to be connected			

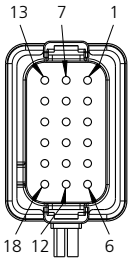
* J1939-15 refers to twisted pair and shielded cables.
The standard/default cables delivered with CAN actuators do not comply with this.

Connection diagram

18-pin

Applicable for: LA36 and LA37

Deutsch



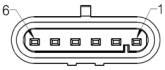
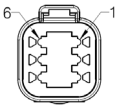
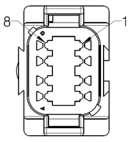
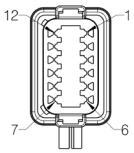
4	+ Split power supply
5	+ 12/24 V DC
6	+ 12/24 V DC
11	GND
12	GND
7	Extends the actuator
8	Retracts the actuator
10	Service port Parallel data +
13	Addressing pin 1 [LSB]
14	Addressing pin 2
15	Addressing pin 3
16	Addressing pin 4 [MSB]
17	CAN_H
18	CAN_L
1	Not to be connected
2	Not to be connected
3	Not to be connected
9	Not to be connected

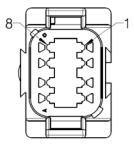
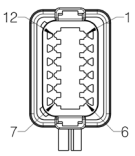
I/O specifications

18-pin

Input/Output	Specification		Comments
Description	CAN bus is compatible with the SAE J1939 standard. Uses CAN messages to command movement, setting parameters and to deliver feedback from the actuator. Actuator identification is provided, using hardware and software addressing.		CAN J1939
Pin 4	+ Split power supply		12 V DC with ≈58 mA current consumption. 24 V DC with ≈32 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 5 Pin 6	12/24 V DC For more information, see the section 'Power supply'	Both pins 5 and 6 must be used.	Note: Do not swap the power supply polarity on the Brown and Blue wires! The PCB is coupled to the housing through a capacitor.
Pin 11 Pin 12	GND Parallel data -	Both pins 11 and 12 must be used.	Common ground for motor, split power supply, service port, and internal parallel connection
Pin 7	Extends the actuator		The signal becomes active at: > 67% of V_{IN} = ON The signal becomes inactive at: < 33% of V_{IN} = OFF Input current: 10 mA
Pin 8	Retracts the actuator		
Pin 10	Service port 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 13	Addressing pin 1 [LSB]		Pins 13 to 16 are dedicated for CAN ID. The four inputs can deliver 15 unique addresses. Connect to VCC or open/GND.
Pin 14	Addressing pin 2		
Pin 15	Addressing pin 3		
Pin 16	Addressing pin 4 [MSB]		
Pin 17	CAN_H		Actuators with CAN bus J1939 do not contain the 120 Ω terminal resistor. The physical layer is in accordance with J1939-15.
Pin 18	CAN_L		
Pin 1	Not to be connected		Factory interface: Connecting these pins may damage the actuator
Pin 2			
Pin 3			
Pin 9			

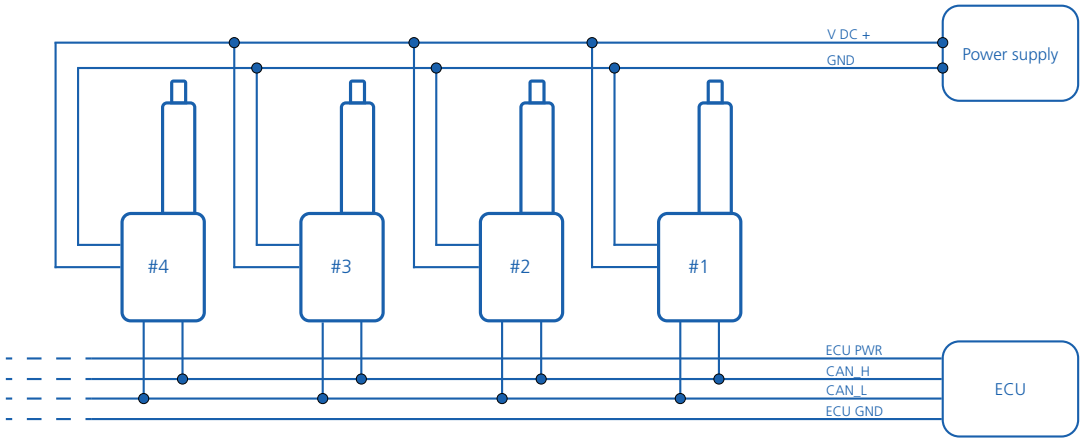
Connection overview

	LA21, LA33, LA36, LA37, LA76, LA77		LA36 6-pin		LA36 9-pin	LA14 and LA25 12-pin
	AMP	Deutsch	AMP	Deutsch	Deutsch	Deutsch
						
Wire colour						
BROWN	2		-	-	-	11
BLUE	1		-	-	-	12
RED	-		2	2	5	8
BLACK	-		1	1	4	7
YELLOW	-		5	5	2	5
GREEN	-		6	6	3	6
VIOLET	-		4	4	7	4
WHITE	-		3	3	8	3
ORANGE	-		-	-	1	2
LIGHT BLUE	-		-	-	6	9

	LA21, LA33, LA36, LA37, LA76, LA77	
	Deutsch	
		
Wire colour	Y-cable	
BROWN	2	2
BLUE	1	1
RED	4	9
BLACK	3	8
YELLOW	7	6
GREEN	8	7
VIOLET	6	5
WHITE	5	4
ORANGE	-	3
LIGHT BLUE	-	10

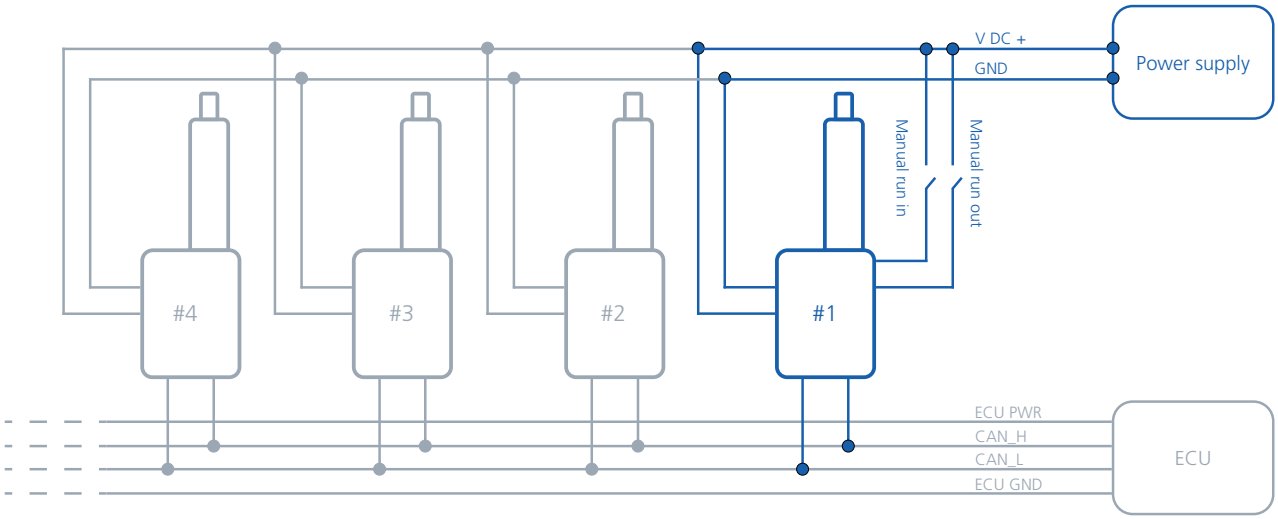
Electrical installation

The J1939-15 defines the Reduced Physical Layer, 250 Kbps, Unshielded Twisted Pair (UTP), and runs with separate communication and power supply wires.



Manual run

During Manual run mode where Inputs 1-3 (1-4 for 18-pin) are low or floating on power-up, the actuator will continue sending status feedback on the CAN bus. However, if other CAN devices are active on the network, Manual run mode will be disengaged. The CAN software address range 128-247 is reserved for this mode. The service interface is also accessible during Manual run mode.



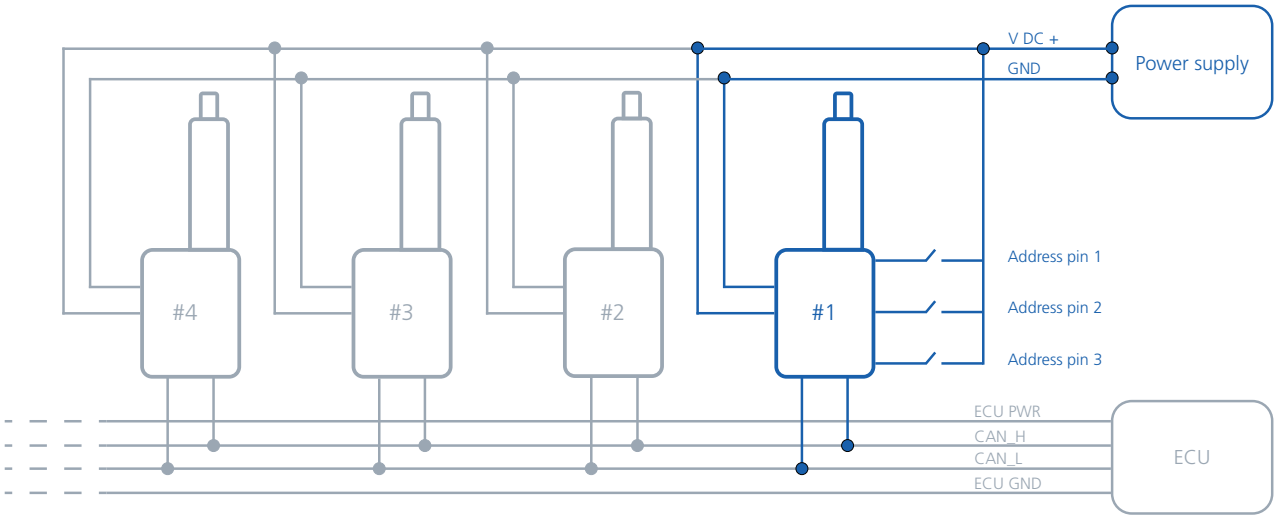
For more information about wiring colours or pin numbers, please see the Connection Diagram.

CAN hardware addressing

HW addressing determines the initial actuator address. A number of input pins, depending on the actuator model, are available for address configuration. The set configuration will be read by the actuator at power-up. If all address pins are open (not connected), the actuator will enter Manual run mode.

6-pin connector

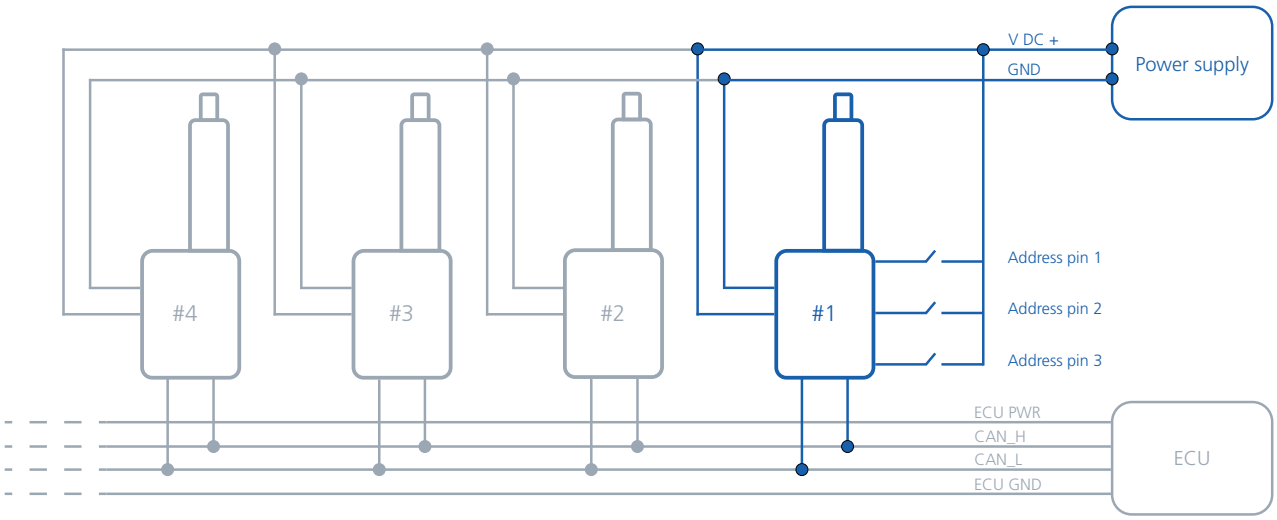
	Black	Red	White	Address	
HW addressing				Node ID	ISO-TP
HW	Pin 1 [MSB]	Pin 2	Pin 3 [LSB]		
N/A	Open	Open	Open	Manual run	0x80 (128)
1	Open	Open	High	0x86 (134)	0x81 (129)
2	Open	High	Open	0x85 (133)	0x82 (130)
3	Open	High	High	0x84 (132)	0x83 (131)
4	High	Open	Open	0x83 (131)	0x84 (132)
5	High	Open	High	0x82(130)	0x85 (133)
6	High	High	Open	0x81 (129)	0x86 (134)
7	High	High	High	0x80 (128)	0x87 (135)



CAN hardware addressing

9- and 12-pin connector

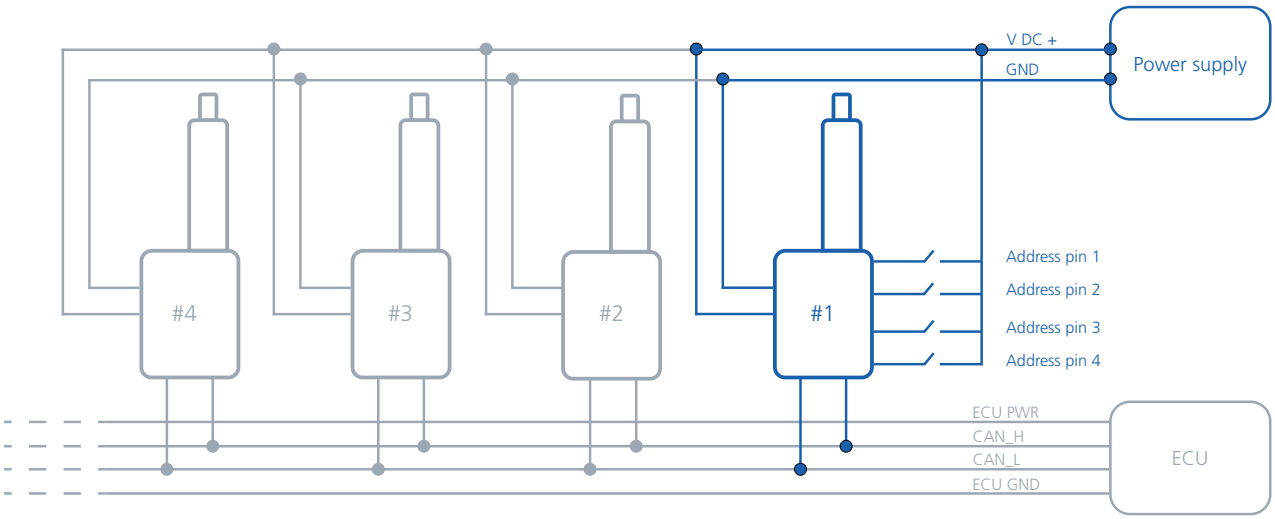
	Black	Red	Light Blue	Address	
HW addressing				Node ID	ISO-TP
HW	Pin 1 [MSB]	Pin 2	Pin 3 [LSB]		
N/A	Open	Open	Open	Manual run	0x80 (128)
1	Open	Open	High	0x86 (134)	0x81 (129)
2	Open	High	Open	0x85 (133)	0x82 (130)
3	Open	High	High	0x84 (132)	0x83 (131)
4	High	Open	Open	0x83 (131)	0x84 (132)
5	High	Open	High	0x82 (130)	0x85 (133)
6	High	High	Open	0x81 (129)	0x86 (134)
7	High	High	High	0x80 (128)	0x87 (135)



CAN hardware addressing

18-pin connector

	Pin 16	Pin 15	Pin 14	Pin 13	Address	
HW addressing					Node ID	ISO-TP
HW	Pin 4 [MSB]	Pin 3	Pin 2	Pin 1 [LSB]		
N/A	Open	Open	Open	Open	Manual run	0x80 (128)
1	Open	Open	Open	High	0x86 (134)	0x81 (129)
2	Open	Open	High	Open	0x85 (133)	0x82 (130)
3	Open	Open	High	High	0x84 (132)	0x83 (131)
4	Open	High	Open	Open	0x83 (131)	0x84 (132)
5	Open	High	Open	High	0x82 (130)	0x85 (133)
6	Open	High	High	Open	0x81 (129)	0x86 (134)
7	Open	High	High	High	0x80 (128)	0x87 (135)
8	High	Open	Open	Open	0xF7 (247)	0x88 (136)
9	High	Open	Open	High		
10	High	Open	High	Open		
11	High	Open	High	High		
12	High	High	Open	Open		
13	High	High	Open	High		
14	High	High	High	Open		
15	High	High	High	High		



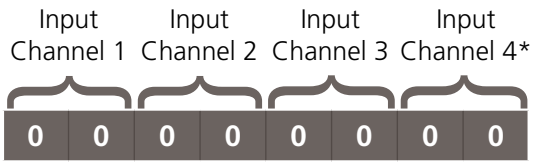
AUX input

The AUX inputs are all-purpose inputs for external devices such as buttons and sensors. Each of the three (or four) input channels consists of two bits which represent the voltage level on the input channel, thereby allowing four levels of the VCC to be expressed through a CAN bus message.

Each channel consists of two bits divided into four levels of VCC:

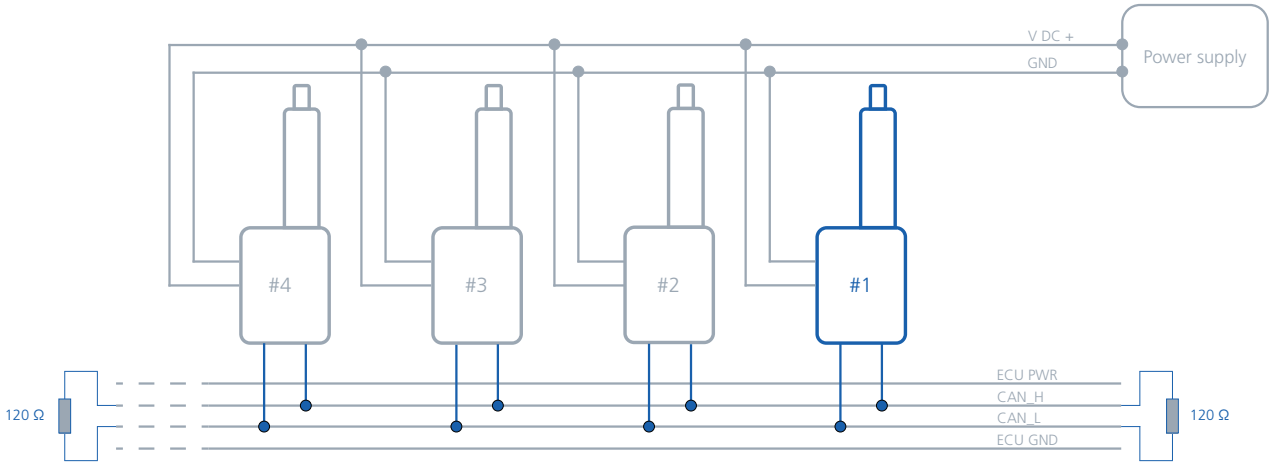
Input bits		VCC				
1	1	■	■	■	■	76-100%
1	0	■	■	■		51-75%
0	1	■	■			26-50%
0	0	■				0-25%

The three (or four) AUX inputs will be present in the last byte of Proprietary B, general status feedback.



Termination

Termination resistors of 120 Ω shall be connected according to the figure below. The actuator does not have internal termination.



* Only available for 18-pin actuators.

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

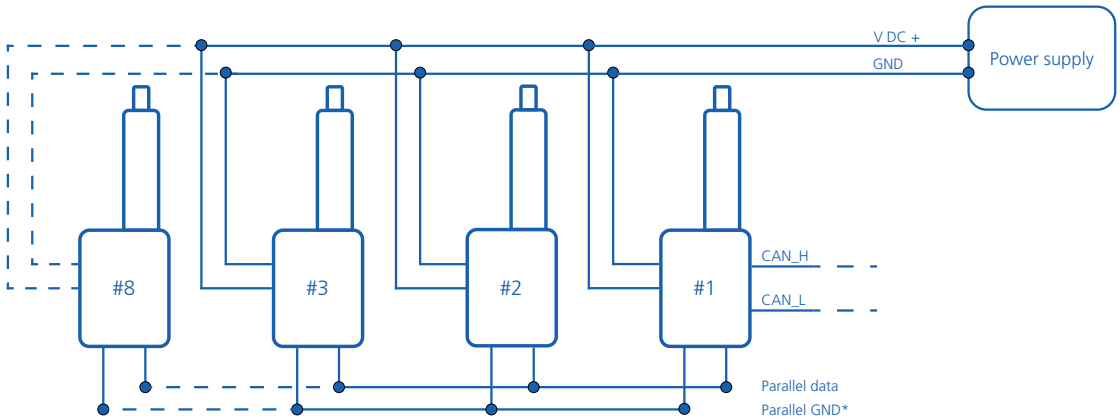
The industrial LINAK® actuators can be ordered with parallel functionality. If this feature is enabled, it is possible to run up to 8 actuators in a parallel system with just one actuator communicating CAN to the master. The system works as a critical parallel, meaning that all actuators must be present 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 metres 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

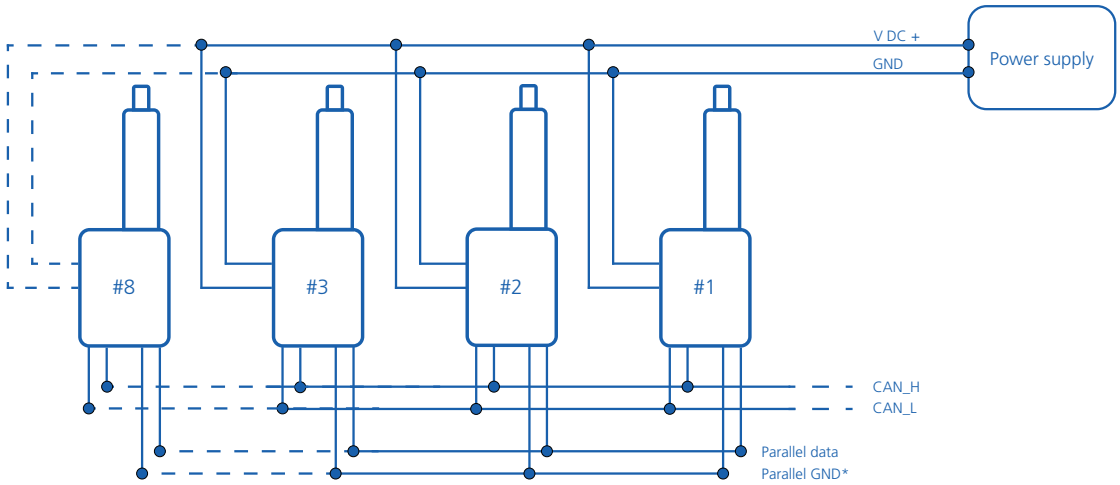
Option 1 - A simple parallel setup



In a simple parallel setup there is only one actuator connected to the bus communication. This actuator receives run commands and shares data with the bus 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 if an error occurs on one of the actuators.

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

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 bus communication. 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 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).

* The 18-pin connector uses Power GND pin 11 and 12 as Parallel GND.

Not applicable for 18-pin actuators versions prior to SW01050031V1-2.

Getting started

This section further describes how to communicate with CAN bus J1939 actuators and contains examples of typical user scenarios and application solutions. All examples include references to registers which are further described in detail below.

CAN SAE J1939 DBC

The SAE J1939 DBC file defines the decoding rules for translating raw J1939 data into meaningful physical values such as speed (km/h), percentage, and more. This makes it easy to interpret data from heavy-duty vehicles like trucks, buses, and tractors.

The LINAK_ CAN_SAE_J1939_DBC file is available for download by using the following link: LINAK_CAN_SAE_J1939_DBC.zip

Broadcasting

From software versions :

SW01050030V1-2 (6-pin)
SW01050019V1-4 (9-pin)
SW01050031V1-2 (18-pin)

The LINAK J1939 supports the global broadcast address 255 (0xFF). When used as the destination address, it signals that the message is intended for all Electronic Control Units (ECUs) on the network, rather than a specific node.

Power supply

CAN bus J1939 actuators are available with the following supply voltage range: 12 V, 24 V, and 48 V DC. The accepted supply voltage range is specified for the version as shown below:

Supply voltage	Function	Voltage range			Valid for
		V_{MIN}	V_{TYP}	V_{MAX}	
12 V	Motor	10.5 V	12 V	16 V	6-pin, 8-pin, 12-pin, and 18-pin
	CAN bus J1939 communication*	8 V	12 V	32 V	
24 V	Motor	18 V	24 V	32 V	6-pin, 8-pin, 9-pin, 12-pin and 18-pin
	CAN bus J1939 communication*	10 V	24 V	39 V	
48 V	Motor	36 V	48 V	58 V	6-pin and 9-pin
	CAN bus J1939 communication*	10 V	48 V	60 V	

* When split power supply is used, the CAN bus J1939 interface will be powered via a separate power input (split supply) from the motor, while the motor power is still used as common ground (GND). If split power supply is not used, the CAN bus J1939 interface will be powered via the motor supply.

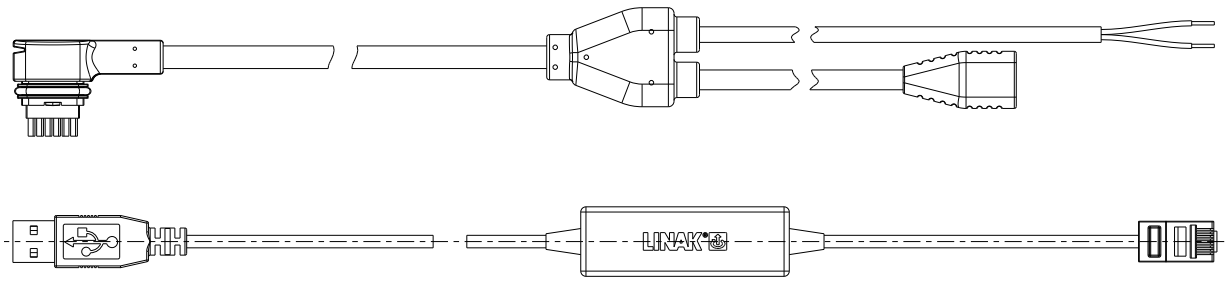
Configuration

Before being integrated into a CAN bus J1939 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.

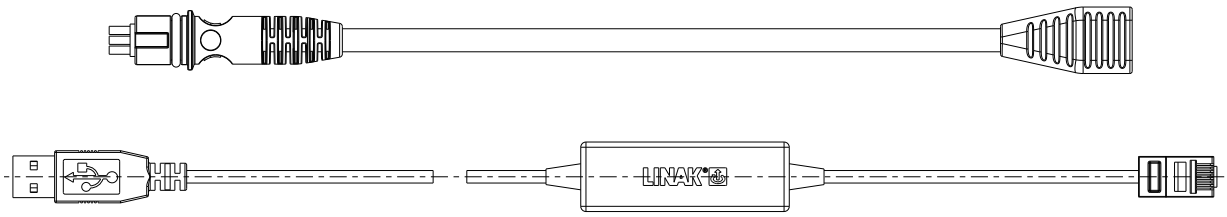


Configuration

Valid for LA36:

6-pin

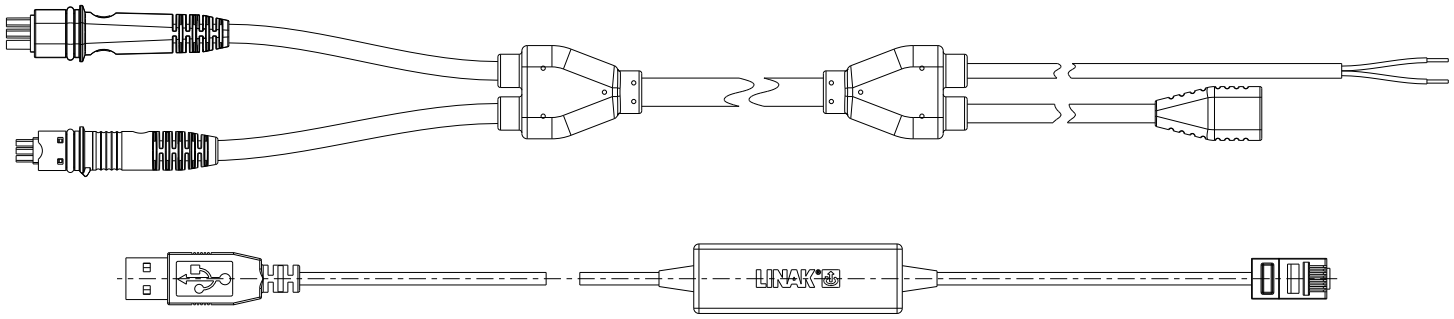
A separate configuration cable kit (item no. 367997 = USB2LIN + adapter cable) is required to use Actuator Connect™ on a PC. This cable must be connected to the 6-pin connector on the actuator side. On the opposite side, power must be applied to the flying leads, and the USB connector must be inserted into your PC.



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

9-pin

A separate configuration cable kit (item no. 0367996 = 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.



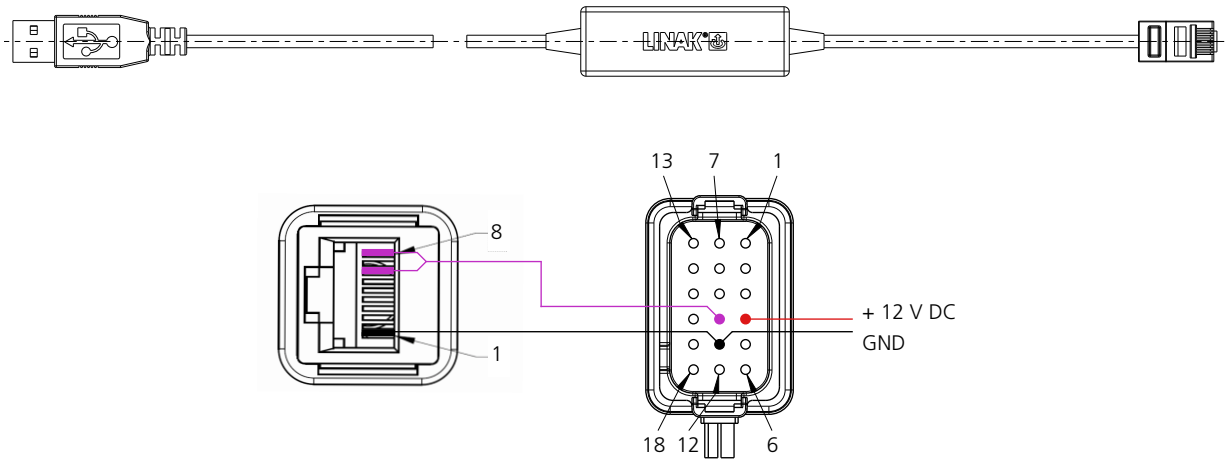
For more information about wiring/connector, please see the Connection Diagram.

Configuration

Valid for LA36 and LA37:

18-pin

A separate USB configuration cable (USB2LIN06-X) is required to use Actuator Connect™ on a PC. This cable must be connected according to the drawing below. On the opposite side, power must be applied to Red and Black on the 18-pin connector (flying leads), and the USB connector must be inserted into your PC.



Parameters to be verified by Actuator Connect™

Parameters	Description
Actuator address	Valid range: 128-247 Default address: 200 (0xC8)
Bit rate	50, 100, 125, 250, 500 or Auto kbps Default bit rate: 250 kbps

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	Proprietary data*	Action
1	W	Proprietary A 03 FB _ _ _ _ _ _	"Position" must be set to = FB03 for 'Stop'. To prevent unintended movement, it is required to send a 'Stop' command before running the actuator.
2	R	Proprietary B _ _ _ _ 00 _ _ _	"Error Code" must be = 00.
3		Proprietary B _ _ _ 80 _ _ _ _	"Status Flags" must be set to either: 80 for 'Idle', 81 for 'Endstop reached in', 82 for 'Endstop reached out'

Run the actuator outwards

Step	Read/ Write	Proprietary data*	Action
1		-	Check that general run prerequisites are fulfilled.
2	W	Proprietary A _ _ FB _ _ _ _ _	"Current" must be set to a value. 00-FA = Current limit 0.25 A/bit FB = Default current limit set via Actuator Connect™ FC-FF = Reserved
3		Proprietary A _ _ _ FB _ _ _ _	"Speed" must be set to a value. 00-FA = Speed 0.5% /bit 201-250 = 100% speed FB = Default speed set via Actuator Connect FC-FF = Reserved
4		Proprietary A _ _ _ _ FB _ _ _	"Soft Start" must be set to a value. 00-FA = Start ramp time 0.05 s/bit FB = Default speed set via Actuator Connect FC-FF = Reserved
5		Proprietary A _ _ _ _ _ FB _ _	"Soft Stop" must be set to a value. 00-FA = Stop ramp time 0.05 s/bit FB = Default speed set via Actuator Connect FC-FF = Reserved
6		Proprietary A _ _ _ _ _ _ FF FF	"Reserved" byte 6 and 7 must be set to FF
7		Proprietary A 01 FB _ _ _ _ _ _	"Position" must be set to = FB01 for 'Run out'
8**	R	Proprietary B _ _ _ 88 _ _ _ _	"Status Flags" change to 88 to indicate that the actuator is running out

* Proprietary A must be sent periodically to keep the signal alive. Must be updated in periods no longer than 250 ms.

** Optional.

Run the actuator to target position (150 mm)

Step	Read/ Write	Proprietary data*	Action
1		-	Check that general run prerequisites are fulfilled.
2	W	Proprietary A _ _ FB _ _ _ _ _	"Current" must be set to a value. 00-FA = Current limit 0.25 A/bit FB = Default current limit set via Actuator Connect™ FC-FF = Reserved
3		Proprietary A _ _ _ FB _ _ _ _	"Speed" must be set to a value. 00-FA = Speed 0.5% /bit 201-250 = 100% speed FB = Default speed set via Actuator Connect FC-FF = Reserved
4		Proprietary A _ _ _ _ FB _ _ _	"Soft Start" must be set to a value. 00-FA = Start ramp time 0.05 s/bit FB = Default speed set via Actuator Connect FC-FF = Reserved
5		Proprietary A _ _ _ _ _ FB _ _	"Soft Stop" must be set to a value. 00-FA = Stop ramp time 0.05 s/bit FB = Default speed set via Actuator Connect FC-FF = Reserved
6		Proprietary A _ _ _ _ _ _ FF FF	"Reserved" byte 6 and 7 must be set to FF
7		Proprietary A DC 05 _ _ _ _ _ _	"Position" must be set to = 05 DC for 'Run to Target Position 150 mm' 1 bit/0.1 mm = 1500 = 0x 05 DC
8**	R	Proprietary B _ _ _ 88 _ _ _ _	"Status Flags" change to 88 or 90 to indicate that either: 88 = actuator is running out 90 = actuator is running in

* Proprietary A must be sent periodically to keep the signal alive. Must be updated in periods no longer than 250 ms.

** 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	Proprietary data*	Action
1	R	Proprietary B _ _ _ 84 _ _ _ _	Confirm that "Status Flags" are set to = 84 for 'Overcurrent'
2	W	Proprietary A 02 FB _ _ _ _ _ _	"Position" must be set to run in the opposite direction of the blockage. Set to = FB 01 for 'Run out' or set to = FB 02 for 'Run in'
3	R	Proprietary B _ _ _ 88 _ _ _ _	"Status Flags" change to 88 or 90 to indicate that either: 88 = actuator is running out 90 = actuator is running in

* Proprietary A must be sent periodically to keep the signal alive. Must be updated in periods no longer than 250 ms.

Clear error

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

Step	Read/ Write	Parameter group	Action
1	R	Proprietary B (Feedback) Byte 4	Confirm that "Error Code" is not = 0
2	W	Proprietary A (Command) Byte 0-1	"Position" set to = 64256 (Clear Error Codes)
3	R	Proprietary B (Feedback) 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.

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

Parameter group

In J1939, the Parameter Group Number (PGN) identifies a specific set of data parameters that are transmitted together in a CAN message.

Each PGN defines the structure and meaning of the data within the message, enabling standardised communication between J1939-compatible devices.

A PGN message can carry up to 8 bytes of data per frame, and larger data sets can be transmitted using multi-packet messages.

Proprietary A (Command)

Command **Parameter Group Number (PGN) 0xEF00** PDU1 Format for Peer-to-Peer communication Minimum transmission rate: 250 ms							
Byte 7 [MSB]	**Byte 6**	**Byte 5**	**Byte 4**	**Byte 3**	**Byte 2**	**Byte 1**	**Byte 0 [LSB]**
Reserved		Ramp Down	Ramp Up	Speed	Current Limit	Position	

Byte(s)	**Command**	**Data type**	**Details**	**Description**	**Scaling**	**SLOT**
Byte 0-1	Position	UINT16	0-64255 [0x0000-FAFF]	Run to position	0.1 mm/ bit	SLOT 283: SAEmd01
			64256 [0xFB00]	Clear Error Code (see Proprietary B 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 Limit	UINT8	0-250 [0x00-FA]	Maximum current limit	0.25 A/bit	SLOT 410: SAEec09
			251 [0xFB]	Default current limit		
			252-255 [0xFC-FF]	Invalid value Actuator will not run		

Proprietary A (Command)

Byte(s)	Command	Data type	Details	Description	Scaling	SLOT
Byte 3	Speed	UINT8	0-200 [0x00-C8]	Speed	0.5% /bit	SLOT 299: SAEpc18 or SLOT 283: SAEmd01
			201-250 [0xC9-FA]	100% speed		
			251 [0xFB]	Default speed		
			252-255 [0xFC-FF]	Invalid value Actuator will not run		
Byte 4	Ramp Up	UINT8	0-250 [0x00-FA]	Ramp up time	0.05 s/bit	SLOT 322: SAEtm19
			251 [0xFB]	Default ramp up time		
			252-255 [0xFC-FF]	Invalid value Actuator will not run		
Byte 5	Ramp Down	UINT8	0-250 [0x00-FA]	Ramp down time	0.05 s/bit	SLOT 322: SAEtm19
			251 [0xFB]	Default ramp down time		
			252-255 [0xFC-FF]	Invalid value Actuator will not run		
Byte 6	Reserved	UINT8	Reserved	Reserved		N/A
Byte 7	Reserved	UINT8				

Proprietary B (Feedback)

Feedback **Parameter Group Number (PGN) 0xEF00** PDU2 Format for Broadcast communication Transmission rate: 100 ms							
Byte 7 [MSB]	**Byte 6**	**Byte 5**	**Byte 4**	**Byte 3**	**Byte 2**	**Byte 1**	**Byte 0 [LSB]**
AUX Input	Speed		Error Code	Status Flags	Current Draw	Position	

Byte(s)	Command	Data type	Details	Description	Scaling	SLOT
Byte 0-1	Position	UINT16	0-64255 [0x0000-FAFF]	Position of the actuator	0.1 mm/bit	SLOT14: SAEds04
			64256-65023 [0xFB00-FDFF]	Reserved		
			65024 [0xFE00]	Position lost		

Proprietary B (Feedback)

Byte(s)	Command	Data type	Details	Description	Scaling	SLOT
Byte 0-1	Position	UINT16	65025-65535 [0xFE01-FFFF]	Reserved		SLOT14: SAEds04
Byte 2	Current Draw	UINT8	0 [0x00]	Not running	0.25 A/bit	SLOT 410: SAEec09
			1-250 [0xFA]	Motor current draw		
			251-253 [0xFB-FD]	Reserved		
			254 [0xFE]	Fault in current measurement circuit		
			255 [0xFF]	Reserved		
Byte 3	Status Flags	UINT8	b0	Endstop reached in	Bit-independent status indicators	N/A
			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 current active error with the highest priority only	N/A
			1 [0x01]	Position sensor		
			2 [0x02]	Overvoltage		
			3 [0x03]	Undervoltage		
			4 [0x04]	Communication sync.		
			5 [0x05]	Endstop switch		
			6 [0x06]	Power on block state		
			7 [0x07]	Temperature		
			8 [0x08]	Motor controller		

* See Error Code descriptions in section: Error codes

Proprietary B (Feedback)

Byte(s)	Command	Data type	Details	Description	Scaling	SLOT
Byte 4	Error Code*	UINT8	9 [0x09]	Internal power supply	8-bit error code showing the current active error with the highest priority only	N/A
			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		
			16 [0x10]	Hardware		
			17 [0x11]	BLDC motor		
			18 [0x12]	Parallel communication		
			19 [0x13]	Parallel running		
			20 [0x14]	Parallel setup stopped		
			254 [0xFE]	Other internal errors (Not specified)		
			255 [0xFF]	Other external errors (Not specified)		
Byte 5-6	Speed	UINT16	0-4015 [0x000-0FAF]	Speed of the actuator	0.1 mm/s /bit	N/A
			4016-65535 [0x0FB0-FFFF]	Reserved		
Byte 7	AUX**	UINT8	b0-b1	Input level 1	1 bit/ 25%VCC	N/A
			b2-b3	Input level 2		
			b4-b5	Input level 3		
			b6-b7	Input level 4		

* See error code descriptions in section: Error codes
** See AUX Input description in section: AUX input

Proprietary B3 (Parallel Feedback)

Parallel Feedback Parameter Group Number (PGN) 0xEF02 PDU2 Format for Broadcast communication Transmission rate: 100 ms (if Parallel is enabled)							
Byte 7 [MSB]	**Byte 6**	**Byte 5**	**Byte 4**	**Byte 3**	**Byte 2**	**Byte 1**	**Byte 0 [LSB]**
Reserved					Parallel Status Flags	Parallel Error Code	Parallel Error Source

Byte(s)	Command	Data type	Details	Description	Scaling
Byte 0	Parallel Error Source	UINT8	0 [0x00]	No error detected	
			1-255 [0x01-FF]	CAN ID of actuator with the highest priority error	
Byte 1	Parallel Error Code*	UINT8	0 [0x00]	No error detected	8-bit error code showing the current active error with the highest priority only
			1 [0x01]	Current overload	
			2 [0x02]	Hardware	
			3 [0x03]	Temperature	
			4 [0x04]	Overvoltage	
			5 [0x05]	Undervoltage	
			6 [0x06]	Analogue input out of range	
			7 [0x07]	Position not changing	
			8 [0x08]	Power on block state	
			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	

* See Parallel error code descriptions in section: Parallel error codes

Proprietary B3 (Parallel Feedback)

Byte(s)	Command	Data type	Details	Description	Scaling
Byte 1	Parallel Error Code*	UINT8	15 [0x0F]	Parallel setup stopped	8-bit error code showing the current active error with the highest priority only
			24 [0x18]	Other error	
			25 [0x19]	Position lost	
Byte 2	Parallel Status Flags	UINT8	b0	Parallel endstop reached out	Bit-independent status indicators
			b1	Parallel endstop reached in	
			b2	Parallel is running outside nominal conditions	
			b3-b7	Reserved. Always high	
Byte 4-8	Reserved	UINT8	Reserved	Reserved	

* See Parallel error code descriptions in section: Parallel error codes

Diagnostics Message (DM)

A standardised set of Parameter Group Numbers (PGNs) defined in SAE J1939-73 that allows Electronic Control Units (ECUs) to report and clear diagnostic information, such as Diagnostic Trouble Codes (DTCs), to the network or a diagnostic tool.

The following diagnostics messages are used in the retrieval of diagnostics data according to SAEJ1939-73 section 5.7.14.1.2:

- DM14 Memory access request
- DM15 Memory access response
- DM16 Binary data transfer

Pointer type: 1 = Directed spatial addressing (parameter IDX)

Pointer extension: 1 = SPM space

Return codes

The status return code for any diagnostics function indicating an error or warning:

Code	Description
0x01	OK
0x80	Invalid parameter index
0x81	Invalid action mode
0x82	Write access denied
0x83	Value underflow
0x84	Value overflow
0x85	Invalid enumerator value

Configuration

Configuration Configuration - Acyclic data exchange							
ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**SLOT**	**Access**
0x7E000	Current Limit - Outwards	UINT8	0-255 [0x00-FF]	Works only when RPDO1 "Current Limit" is 251 [0xFB]*	0.25 A/bit	SLOT 410: SAEec09	R/W
0x7E001	Current Limit - Inwards						
0x7E002	Ramp Up - Outwards	UINT16	0-65535 [0x0000-FFFF]	Works only when RPDO1 "Ramp Up" is 251 [0xFB]	1 ms/bit	SLOT 132: SAEtm02	R/W
0x7E003	Ramp Up - Inwards						
0x7E004	Ramp Down - Outwards			Works only when RPDO1 "Ramp Down" is 251 [0xFB]			
0x7E005	Ramp Down - Inwards						

* Actuator must power cycle before changes apply.

Configuration

Configuration Configuration - Acyclic data exchange							
ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**SLOT**	**Access**
0x7E006	Maximum Speed	UINT8	0-200 [0x00-C8]	Overrules RPDO1 "Speed"	0.5% /bit	SLOT 299: SAEpc18	R/W
			201-255 [0xC9-FF]		100%		
0x7E007	Virtual Endstop - Outwards	UINT16	0 [0x0000]	Sets the virtual endstop outwards position	Disabled	SLOT 14: SAEds04	R/W
			1-699]0x0001-02BB]		Do NOT set below 70 mm*		
			700-65535 [0x02BC-FFFF]		0.1 mm/bit		
0x7E008	Virtual Endstop - Inwards	UINT16	0 [0x0000]	Sets the virtual endstop inwards position	Disabled	SLOT 14: SAEds04	R/W
			1-350 [0x0001-015E]		0.1 mm/bit		
			351-65535 [0x015F-FFFF]		Do NOT set above 35 mm*		
0x7E009	Actuator Address	UINT8	0-253 [0x00-0xFD]	Set or read the CAN node-ID	N/A	SLOT 35: SAEsa01	R/W
0x7E00A	CAN baud rate	UINT16	Allowed values: 125, 250, 500	250 = 250 kbit/s Set MSB for Autobaud	Value in kbit/s	SLOT 283: SAEmd01	R/W

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

Diagnostics

Configuration Configuration - Acyclic data exchange							
ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**SLOT**	**Access**
0x7E00B	UIN	UINT32		Unique 8-digit identification number		SLOT 283: SAEmd01	R
Software							
0x7E00C	Variant	UINT32		SW**xxxxxxx**Vx-x		SLOT 283: SAEmd01	R
0x7E00D	Version Major			SWxxxxxxxV**x**-x			
0x7E00E	Version Minor			SWxxxxxxxVx-**x**			

Diagnostics

Configuration Configuration - Acyclic data exchange							
ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**SLOT**	**Access**
0x7E00F	Config. Production Order Number	UINT32		Unique 8-digit identification number		SLOT 283: SAEmd01	R
0x7E010	Production Date			yyyymmdd		SLOT 283: SAEmd01	
0x7E011	Max. Current Seen	UINT8		0.25 A/bit		SLOT 410: SAEec09	
0x7E012	Max. FET Temperature Seen			1°C /bit - 40°C		SLOT 64: SAEtp01	
0x7E013	Max. Ambient Temperature Seen						
0x7E014	Min. Ambient Temperature Seen						
0x7E015	Total Current Usage	UINT32		1 (Ampere*seconds)/bit		SLOT 283: SAEmd01	
0x7E016	Total Runtime			1 s/bit			
Number of stops due to							
0x7E017	Reason for Last Stop	UINT16		Reason for last stop		SLOT 64: SAEct05	
0x7E018	Overvoltage	UINT8		Number of stops		SLOT 133: SAEct03	R
0x7E019	FET Overvoltage						
0x7E01A	Ambient Over-temperature						
0x7E01B	Undervoltage						
0x7E01C	Hall Error						
0x7E01D	Endstop Switch Error						
0x7E01E	Default Current Limit Overloads - Out						
0x7E01F	Default Current Limit Overloads - In						

Diagnostics

Configuration Configuration - Acyclic data exchange							
ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**SLOT**	**Access**
Number of resettable stops due to							
0x7E020	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.		SLOT 133: SAEct03	R/W
0x7E021	Custom Current Limit Overloads - In						
Number of							
0x7E022	Communi-cation Errors	UINT16		Number of		SLOT 208: SAEct05	R
0x7E023	Endstop Reached - Out	UINT32				SLOT 209: SAEct07	
0x7E024	Endstop Reached - In						
0x7E025	Starts - Out						
0x7E026	Starts - In						
0x7E027	Total Piston Distance Travelled	UINT32		5 m/bit		SLOT 38: SAEds09	R
0x7E028	Proprietary B Transmission Rate	UINT16		1 ms/bit		SLOT 132: SAEtm02	R/W
Reason for last stop - ID 0: see Reason for Last Stop definitions in section below							
0x7E029	Reason	UINT16		Reason for stop		SLOT 283: SAEmd01	R
0x7E02A	Count	UINT8		Number of stops in a row		SLOT 133: SAEct03	
0x7E02B	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							
0x7E02C	Reason	UINT16		Reason for stop		SLOT 283: SAEmd01	R
0x7E02D	Count	UINT8		Number of stops in a row		SLOT 133: SAEct03	
0x7E02E	Powered Time	UINT32		Powered time when the last stop occurred	1 s/bit		

Diagnostics

Configuration Configuration - Acyclic data exchange							
ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**SLOT**	**Access**
Reason for last stop - ID 2: see Reason for Last Stop definitions in section below							
0x7E02F	Reason	UINT16		Reason for stop		SLOT 283: SAEmd01	R
0x7E030	Count	UINT8		Number of stops in a row		SLOT 133: SAEct03	
0x7E031	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							
0x7E032	Reason	UINT16		Reason for stop		SLOT 283: SAEmd01	R
0x7E033	Count	UINT8		Number of stops in a row		SLOT 133: SAEct03	
0x7E034	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							
0x7E035	Reason	UINT16		Reason for stop		SLOT 283: SAEmd01	R
0x7E036	Count	UINT8		Number of stops in a row		SLOT 133: SAEct03	
0x7E037	Powered Time	UINT32		Powered time when the last stop occurred	1 s/bit		
0x7E03A	Total Corrected Distance	UINT32		1 mm/bit			R
0x7E03C	FET Temperature	UINT8		1°C /bit - 40°C		SLOT 67: SAEtp01	
0x7E03D	Ambient Temperature						
0x7E03E	No. of Hall Shifts at Learn	UINT16		0.1 mm/bit		SLOT 14: SAEds04	
0x7E03F	Zero Point Offset at Learn						
0x7E040	Production Order Number	UINT32		Unique 8-digit identification number		SLOT 283: SAEmd01	

Diagnostics

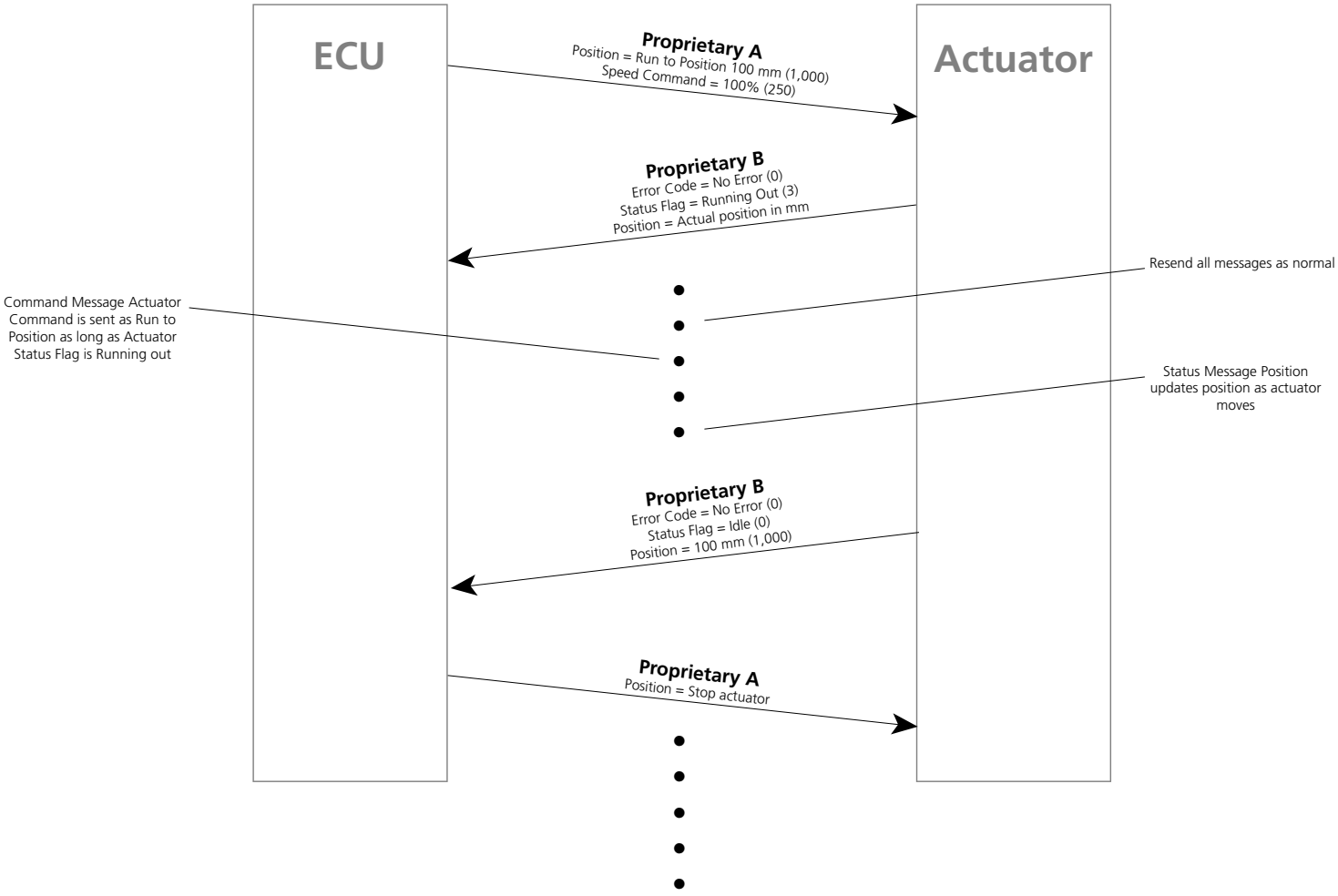
Configuration Configuration - Acyclic data exchange							
ID	**Parameter**	**Data type**	**Details**	**Description**	**Scaling**	**SLOT**	**Access**
LINAK special functions							
0x7E041	Functions	UINT8	0 [0x0]	Reserved		SLOT 283: SAEmd01	R/W
			1 [0x1]	Restart actuator			
			2-255 [0x2-FF]	Reserved			
CAN addresses in parallel system							
0x7E042	Address 1	UINT32		Sorted in descending order			R
0x7E043	Address 2						
0x7E044	Address 3						
0x7E045	Address 4						
0x7E046	Address 5						
0x7E047	Address 6						
0x7E048	Address 7						
0x7E049	Address 8						
0x7E04A	Powered Time	UINT32		1 s/bit		SLOT 6: SAEtm06	R
0x7E04B	Remaining Life	UINT8	0-100 [0x0-64]	Remaining life (Counting down)	1% /bit	SLOT 46: SAEpc06	
			101-249 [0x65-F9]	Reserved			
			250 [0xFA]	Remaining life not supported			
			251-255 [0xFB-FF]	Reserved			
0x7E04C	Interval Between Proprietary B3 Transmissions	UINT16		1 ms/bit		SLOT 132: SAEtm02	R/W

Reason for last stop definition

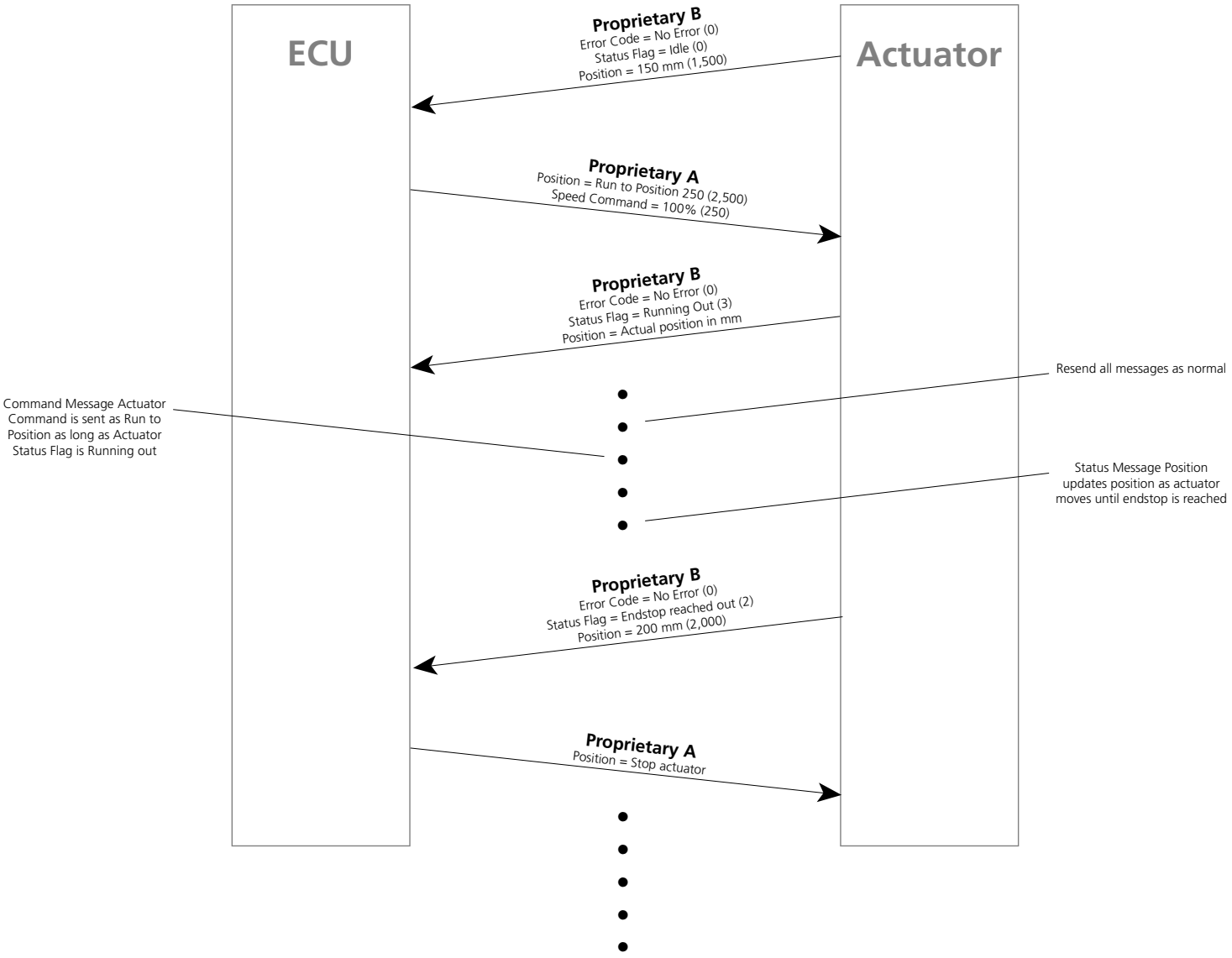
Reason for Last Stop	Function	Description
1	H-bridge fault	There is a hardware problem causing the system to malfunction or the gate driver to not respond correctly.
2	Overtemperature	The device or the surrounding temperature got too hot while it was running.
4	Undervoltage	The voltage dropped below 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.

Use cases

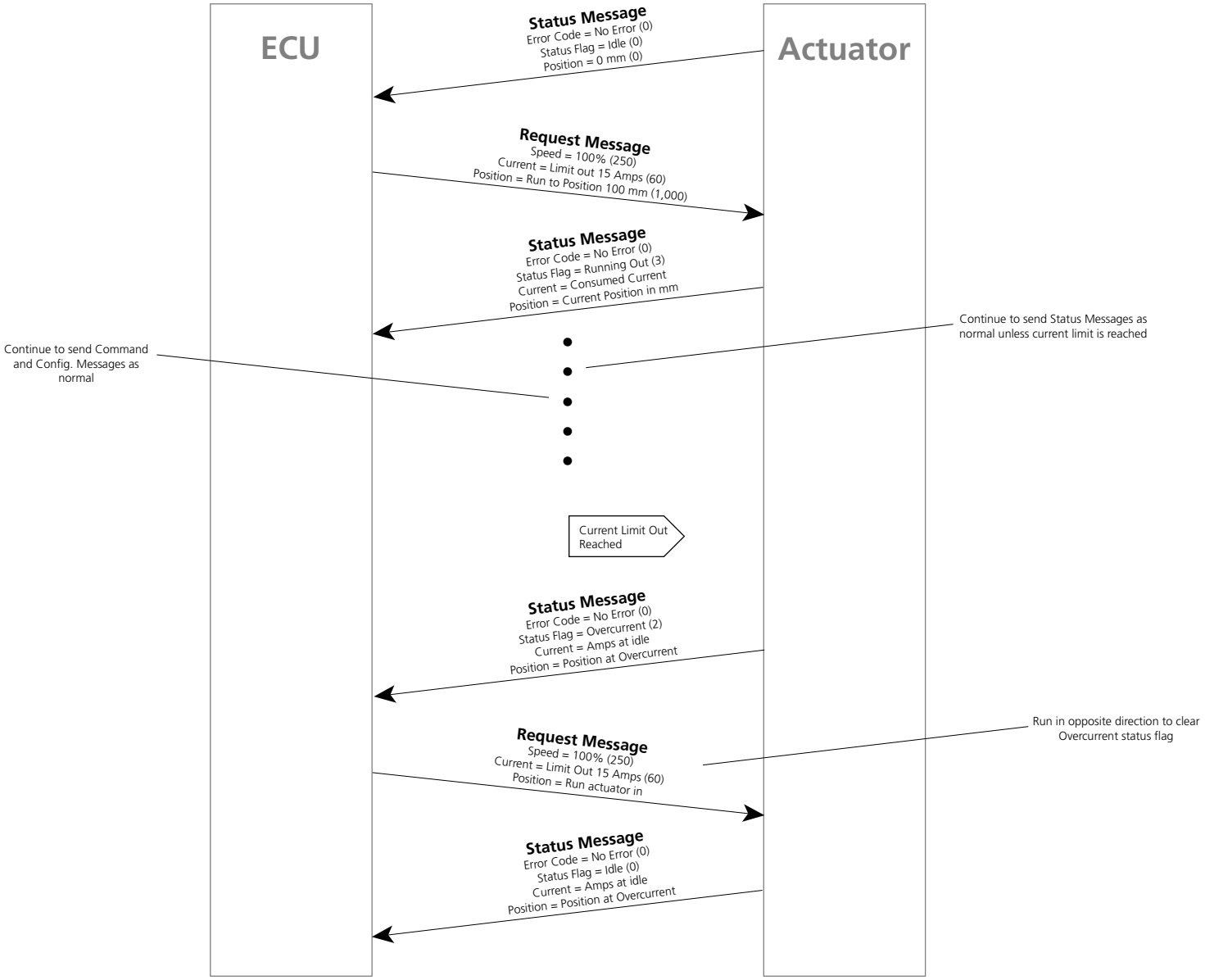
Example 1: 0 to 100 mm ‘Run to Position’ on a 200 mm actuator



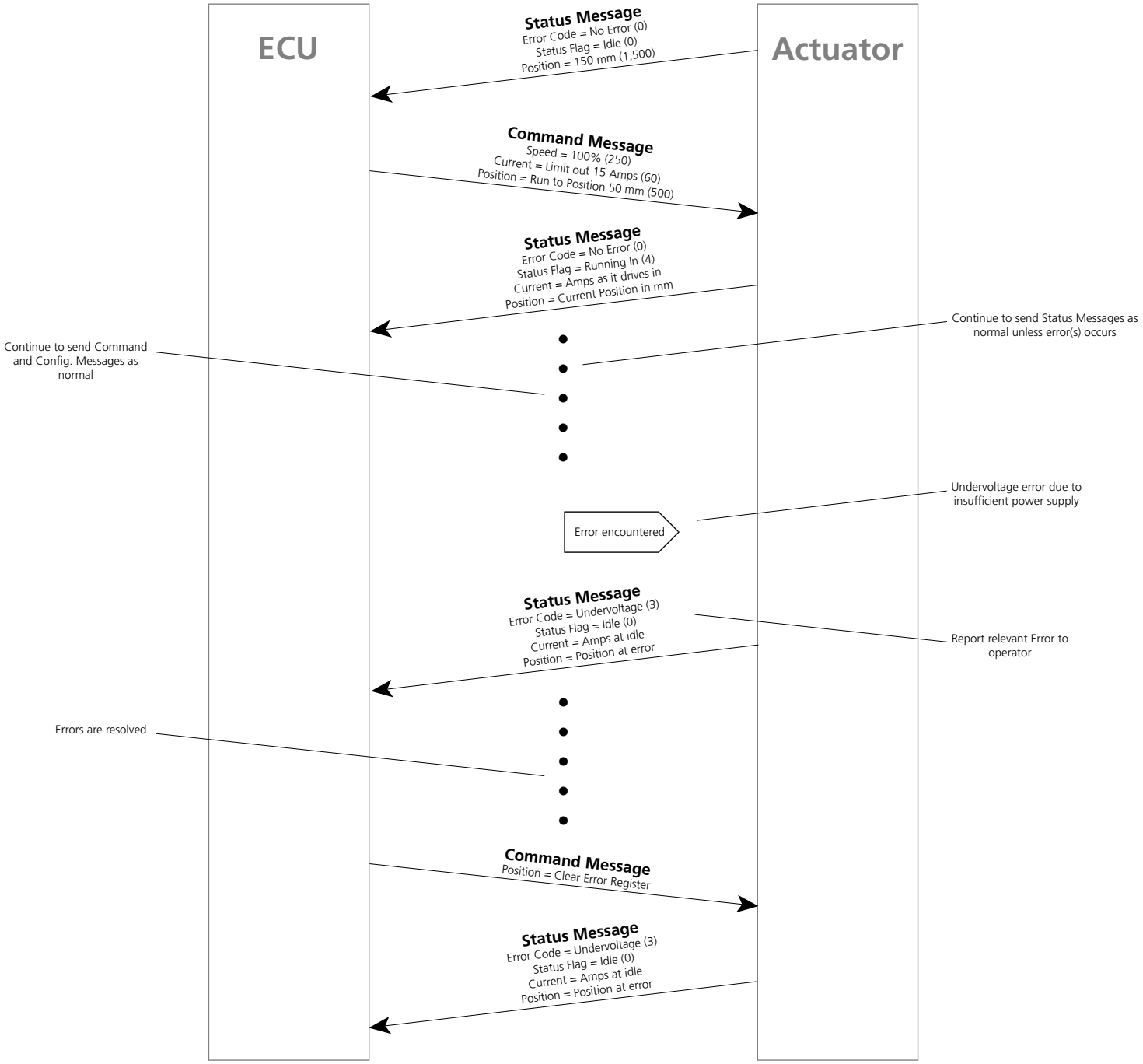
Example 2: 150 to 250 mm ‘Run to Position’ on a 200 mm actuator



Example 3: 0 to 100 mm ‘Run to Position’ on a 200 mm actuator: Overcurrent limit reached



Example 4: 150 to 50 mm 'Run to Position' on a 200 mm actuator: Undervoltage error



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 'Stop' (0x03FB) command before sending a 'Run' command. 3. Make sure Proprietary A is sent at least every 250 ms.
Feedback data is available but the actuator is not able to run.	Some actuators are designed with a split supply PCB. This means that the controller can receive data from the actuator despite not supplying V_{CC} to the motor itself from a power supply.
Why does the PLC show a reversed data order?	Some controllers may reverse the byte order. Please make sure the correct Most Significant Byte [MSB] and Least Significant Byte [LSB] are matching your configuration.
The master does not receive any response from the actuator.	1. Make sure the device has the expected address. The address can be changed via Actuator Connect™. 2. Make sure CAN High and CAN Low are not swapped.
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	**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.
2	**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.
3	**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.
4	**Communication sync.** Heartbeat from the master is not within the expected heartbeat interval. Consult the documentation for minimum requirements for heartbeat interval.
5	**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.

Error codes

Error	Description
6	**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.
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.
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.

Error codes

Error	Description
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.

Parallel error codes

Error	Description
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.
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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