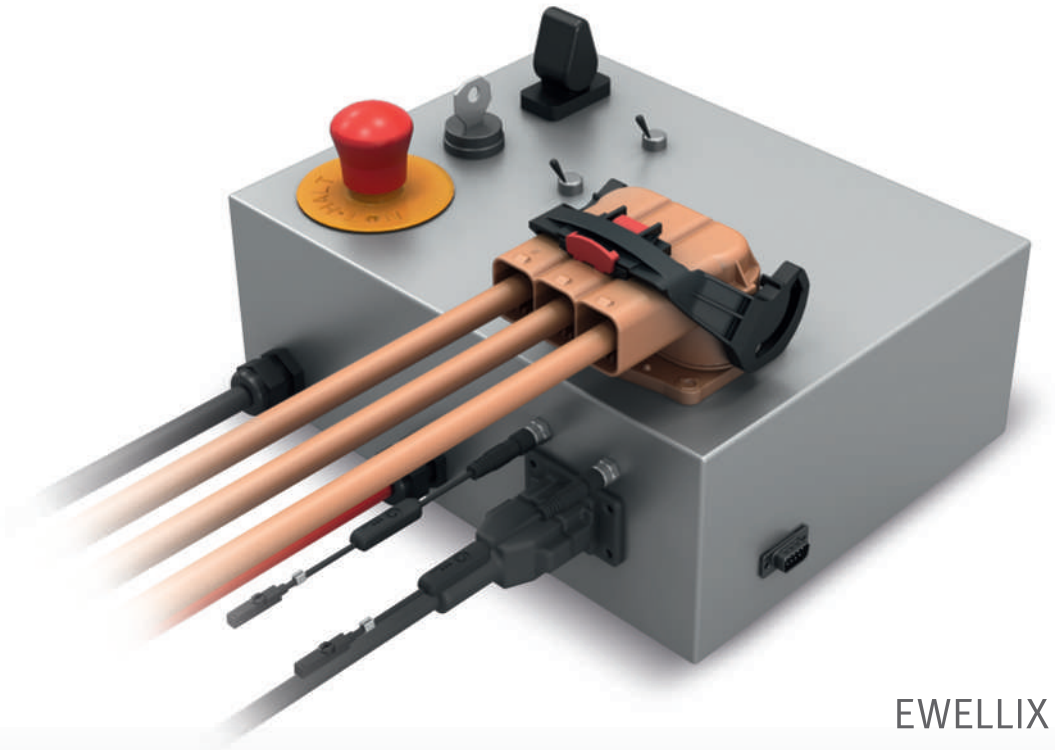


EWELLIX

Electromechanical EWELLIX Linear Actuator

e-MOVEKIT

User Manual

We pioneer motion

SCHAEFFLER

Contents

1 About the manual

1.1 About the manual

This manual is part of the product and contains important information. Read the manual thoroughly prior to use and ensure that the instructions are strictly observed.

The original language of the manual is German. All other languages are translations from the original language.

1.2 Symbols

The warning and hazard symbols are defined in accordance with ANSI Z535.6-2011.

1 Warning and hazard symbols

Signs and descriptions	
DANGER	In case of non-compliance, death or serious injury will occur.
WARNING	In case of non-compliance, death or serious injury may occur.
CAUTION	In case of non-compliance, minor or moderate injury may occur.
NOTICE	In case of non-compliance, damage or malfunctions in the product or the adjacent construction may occur.

1.3 Signs

The warning, prohibition, and mandatory signs are defined in accordance with DIN EN ISO 7010 or DIN 4844-2.

2 Warning, prohibition, and mandatory signs

Signs and descriptions	
	General warning
	Electrical voltage warning
	Flammable materials warning
	Explosive substances warning
	Crush warning
	Hand injury warning
	Observe the manual
	Wear safety shoes
	Wear eye protection
	General mandatory sign

1.4 Availability

A current version of this manual is available at:
https://www.schaeffler.de/std/2215

1.5 Applicable documents

Safe and proper operation is only possible if this user manual and the following information are heeded:

- regulations applicable at the place of use, according to the system into which the stack is integrated and the prevailing environmental conditions
- recognized technical rules for safe and professional work
- local laws and regulations
- environmental protection regulations
- other applicable regulations
- TPI 293
- VP-10005-EN Manual F Series Motor Controller

Further information

TPI 293 | EWELLIX Elektromechanical Linear Actuator EMA-100 |
https://www.schaeffler.de/std/202F

VP-10005-EN | F Series Motor Controller |
https://www.schaeffler.de/std/220A

1.6 Legal notices

The information in this manual reflects the status at the time of publication.

Unauthorized modifications to or improper use of the product are not permitted. Schaeffler accepts no liability in these cases.

1.7 Images

The images in this manual may be schematic representations and may differ from the delivered device.

2 General safety regulations

2.1 Intended use

The e-MOVEKIT is designed for use in conjunction with the EMA-100 actuator. The e-MOVEKIT controls the execution of linear movements with a defined stroke, defined force, and constant speed within an application. 2 variants are available:

The Quick Start e-MOVEKIT is intended exclusively for use under laboratory conditions and for prototype development.
It is not approved for continuous operation or as the primary control device in productive applications.

The System Integration e-MOVEKIT is designed for permanent installation in applications. The System Integration e-MOVEKIT controls an EMA-100 actuator by generating a defined movement over a specified travel distance via motor speed.

Integration with an emergency stop button is required for its intended use. The Quick Start e-MOVEKIT is supplied with an emergency stop button.

Only use original spare parts and accessories supplied by Schaeffler.

2.2 Improper use

The following uses of the e-MOVEKIT are considered improper:

- use outside of the specified environmental conditions
- control of more than one actuator
- use as a safety-critical control system

Use as a functional safety system in accordance with DIN EN ISO 13849-1 or IEC 62061. A safety assessment at safety level must be carried out by the end user or integrator.

2.3 Safety equipment

- The individual components have been designed in accordance with DIN EN 60204-1.
- The EMA-100's motor features an integrated electromechanical brake, which prevents back-driving in the event of a power failure.
- Several safety functions prevent actuator movement if safety-critical criteria are not met, e.g., open power lines or motor encoder faults.
- The e-MOVEKIT checks whether a CANopen connection is present if it is configured for CANopen commands. In the absence of a CANopen signal, the controller stops actuator movement.
- The main power supply to the Quick Start e-MOVEKIT can be interrupted via an emergency stop button. This stops actuator movement and activates the electromechanical motor brake. A safety relay for integration into a functional safety system with a safe torque off (STO) state is integrated.

2.4 Potential risks

The following risks must be taken into account in an application-specific risk assessment when operating the e-MOVEKIT:

- The actuator does not detect an impact automatically and does not stop movement upon impact. This can lead to:
  - crushing of people or objects in the path of the actuator or the machine in which the actuator is installed
  - dynamic collision with a person or object causing serious injury, death, or property damage
- The actuator path may be longer than the permissible travel range in the application or machine. The actuator does not detect mechanical limits and does not stop movement when the mechanical limitations of the application/machine are reached.
  - Potential collisions may occur at the ends of the actuator's operating stroke, causing serious injury, death, or property damage.

2.5 Hazards

DANGER

Electric shock

Risk of serious injury or death due to improper maintenance

- Work on electrical systems may only be carried out by professional electricians.

CAUTION

Moving parts

Hand injuries due to crushing

- Ensure that no persons are located in the stroke area of the device during operation.
- Observe the information on the product label.
- Never tamper with the elements that are connected to the device while the device is in operation.

2.6 Modifications to the device

To avoid hazardous situations and to ensure optimal performance, do not make any changes or modifications to the device that have not been specifically authorized by Schaeffler.

The controller can be configured using CAN outside the settings described in this user manual. Such modifications to the settings are considered improper use.

Any changes to the parameters of the motor controller carried out in this way must comply with the manufacturer's user manual (VP-10005-EN F Series Motor Controller) and are not covered in this manual.

Further information

VP-10005-EN | F Series Motor Controller |
https://www.schaeffler.de/std/220A

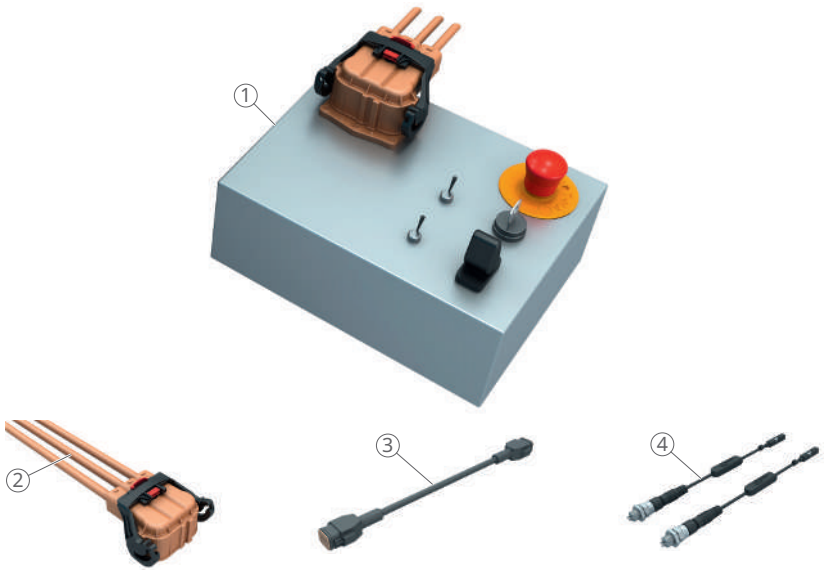
3 Scope of delivery

The e-MOVEKIT is available in 2 product versions:

Quick Start e-MOVEKIT

The scope of delivery comprises:

1 Scope of delivery Quick Start e-MOVEKIT

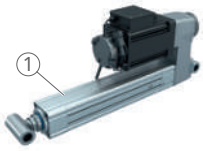


1	Quick Start e-MOVEKIT control box	2	motor power cable
3	motor control cable	4	sensor extensions

- Quick Start e-MOVEKIT control box
- motor power cable, premounted on the actuator
- motor control cable
- sensor extensions, premounted on the actuator
- magnetic limit switch, premounted on the actuator

Not included, but necessary for operation:

2 Not included in the scope of delivery



1	EMA-100 linear actuator		

- EMA-100 linear actuator with AC induction motor Nidec N11

System Integration e-MOVEKIT

The scope of delivery comprises:

3 Scope of delivery System Integration e-MOVEKIT

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1	System Integration e-MOVEKIT motor controller		

- System Integration e-MOVEKIT motor controller (Curtis AC F2-A 24-200-051)

Not included, but necessary for operation:

4 Not included in the scope of delivery

001DE11A

1	EMA-100 linear actuator	2	motor power cable 25mm²
3	23-pin AMPSEAL connector for I/O to motor controller		

- EMA-100 linear actuator with AC induction motor Nidec N11
- motor power cable 25 mm² (ZKA-377947)
- 23-pin AMPSEAL connector for I/O to motor controller (ZKA-377944)

3.1 Check for transport damage

1. Check the product immediately upon delivery for any damage during transit.
2. Report any damage during transit promptly as a complaint to the carrier.

3.2 Check for defects

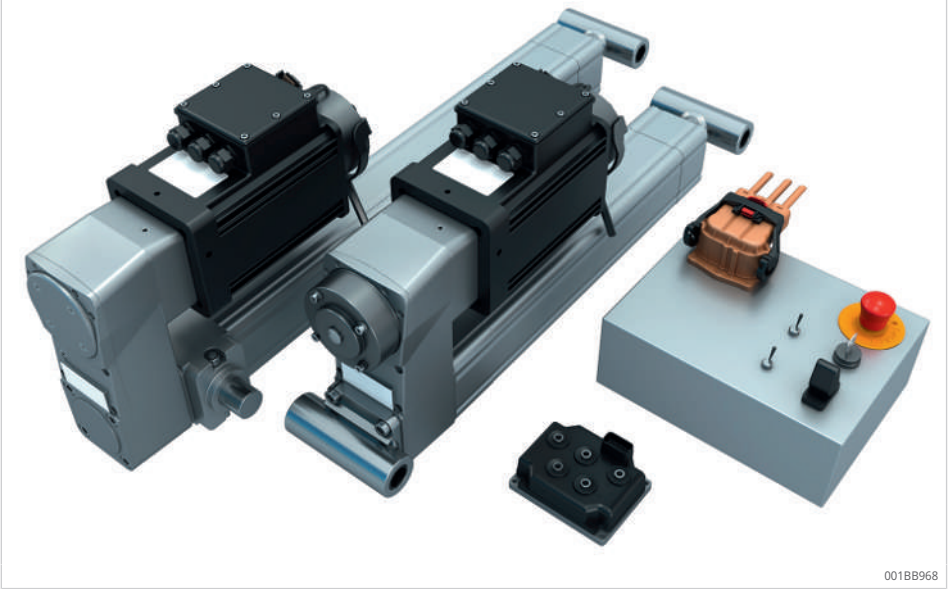
1. Check the product immediately upon delivery for any visible defects.
2. Report any defects promptly to the distributor of the product.
3. Do not put damaged products into operation.

4 Product description

The e-MOVEKIT is a fully electrified linear drive. A control system is already integrated, eliminating the need for in-house development and dimensioning.

The system consists of all components required to drive a linear actuator in mobile machinery with 24-V batteries. Linear movements are controlled by the system's analog inputs or CAN commands.

5 e-MOVEKIT



4.1 Control

2 control systems are available:

- Quick Start e-MOVEKIT
- System Integration e-MOVEKIT

The control systems can be combined with any drive configuration.

Schaeffler configures all motor controller parameters according to the selected actuator. Both e-MOVEKITs are equipped with the AC F2-A motor controller from Curtis Instruments.

Quick Start e-MOVEKIT

The Quick Start e-MOVEKIT supports the transition from an existing hydraulic system to a fully electric system.

The actuator can be controlled using the joystick:

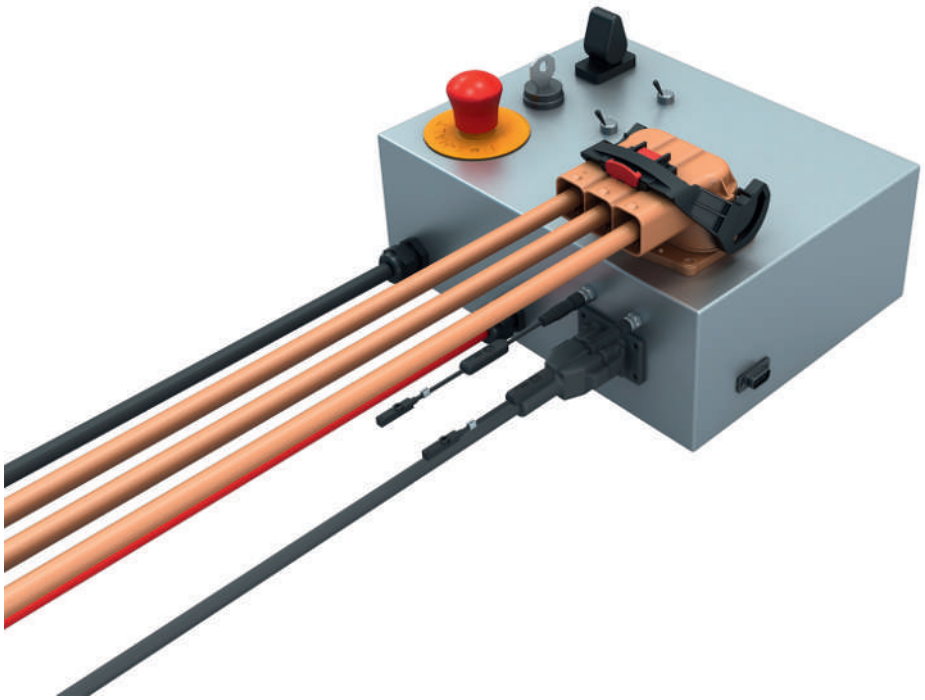
- When the joystick is pushed toward the emergency stop button, the actuator extends.
- When the joystick is moved away from the emergency stop button, the actuator retracts.

The Quick Start e-MOVEKIT is equipped with safety features in the form of end-position switches that prevent damage during commissioning as well as any overrunning of the actuator's physical end stops.

The maximum speed of the linear actuator corresponds to the definition in the e-MOVEKIT type key.

The factory-installed limit switches are preconfigured. The limit switches slow actuator movement 40 mm before reaching the lower and upper end positions. At this point, the speed is reduced to 10 % of the value defined in the e-MOVEKIT type key. The actuator comes to a complete stop when the lower and upper end positions are reached.

6 Quick Start e-MOVEKIT



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System Integration e-MOVEKIT

The System Integration e-MOVEKIT enables integration into any mobile application and requires knowledge of motor controller technology. The system is already configured with the motor parameters for Nidec AC induction motor. The customer is responsible for integrating the system into the application.

The System Integration e-MOVEKIT is suitable for single-handed drive control.

7 System Integration e-MOVEKIT

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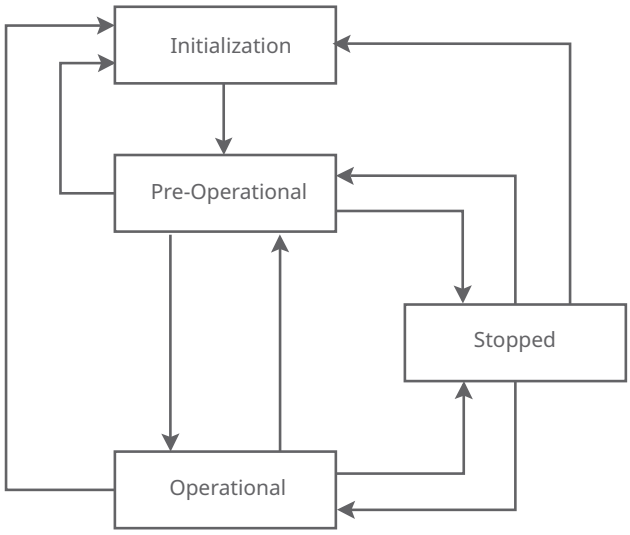
8 Control state diagram



4.2 Speed mode

When a drive command is given, the controller drives the motor at the desired speed, adjusting power consumption and torque generation accordingly.

The speed mode defines an acceleration ramp for smooth starts and stops. This acceleration ramp reduces the load on the mechanical components and ensures a longer service life.

The speed mode has the following software features:

- CANopen drive commands
- analog drive commands, e.g., FWD/REV or WIG/WAG
- limit switch integration as standard for Quick Start e-MOVEKIT
- limit switch integration optional for System Integration e-MOVEKIT
- validated safety detection and fault prevention, e.g., in the event of loss of motor braking torque or uncontrolled travel

5 Transport and storage

5.1 Packaging

The individual packaged pieces have been packaged appropriately according to the expected transport conditions.

The packaging is intended to protect the individual components from transport damage, corrosion and other damage prior to installation. Do not, therefore, destroy the packaging and only remove it shortly before installation. Keep the packaging in case of return shipment to the manufacturer.

5.2 Storage

Pack the actuator in its original packaging for storage.

- Do not store outside and protect from UV radiation.
- Always store in a dry and dust-free environment.
- Keep away from all aggressive media.
- Avoid mechanical vibrations.
- Storage temperature: –40 °C to 50 °C
- Relative humidity: max. 95 % without the formation of condensation
- If you plan to store the product for more than 3 months, check the general condition of all parts of the packaging monthly. If necessary, refresh or renew the conservation.
- Relubricate the actuator if it has been stored for more than 3 years.
- It is possible that there are notices on the packaging concerning storage that go beyond the requirements listed here. If so, follow these notices.

5.3 Handling

Handle the actuator in a safe manner to prevent injury or damage to material and the environment. For long actuators, use appropriate tools to lift and move the actuator, such as safety ropes and cranes, due to the heavier weight.

If the drive is ordered with a motor adapter, it is equipped with an M12 thread for handling. It is recommended to use an eye bolt and a rod clevis to secure the lifting device with a safety cord.

6 Assembly

For installation of the actuator, follow the operating, assembly, and maintenance instructions in the EMA-100 manuals. For installation of the System Integration e-MOVEKIT, follow the operating, assembly, and maintenance instructions for the motor controller.

Further information

TPI 293 | EWELLIX Elektromechanical Linear Actuator EMA-100 | https://www.schaeffler.de/std/202F

VP-10005-EN | F Series Motor Controller | https://www.schaeffler.de/std/220A

6.1 Quick Start e-MOVEKIT

Required support aids

A CAN-dongle and compatible software, e.g., from Kvaser, are recommended for programming the e-MOVEKIT.

Electrical connection

DANGER

Severe current arcs caused by short circuit

Short-circuiting the battery terminals poses a life-threatening hazard due to current arcs.

- Open the battery circuit before working on the motor control circuit.
- Wear safety glasses and personal protective equipment.
- Always use properly insulated tools to avoid short circuits.

1. Connect the DEUTSCH DT06 connector of the motor control cable with the DEUTSCH DT04-08PA connector of the N11 AC induction motor on the actuator.
2. Connect the DEUTSCH DT06-08SA connector at the other end of the motor control cable with the DEUTSCH DT04-08PS-L012 connector on the e-MOVEKIT.
3. Insert the M8 sensor cable into the M8 socket on the e-MOVEKIT.
4. Insert the sensor cable located in the push tube area into the socket labeled “Limit Switch Front” on the e-MOVEKIT.
5. Insert the sensor cable located in the motor area into the socket labeled “Limit Switch Back” on the e-MOVEKIT.
6. Insert the AMPHENOL connector of the motor power cable into the socket on the e-MOVEKIT. Ensure that the connector is fully inserted and the locking handle is closed.

CAUTION

Risk of injury due to arcing and sudden actuator movement

During connection to the battery, arcing or immediate actuator movement may occur after the connection is made.

- When connecting the battery, ensure that the key-switch and interlock are in the OFF position and the joystick is in the neutral position.

CAUTION

Risk of fire or explosion due to hydrogen gas

Lead-acid batteries may release flammable hydrogen gas during charging and discharging, which can ignite.

- Observe the safety instructions provided by the battery manufacturer.
- Wear safety glasses when servicing, charging, or working near the battery.

⚠ CAUTION

Explosion hazard due to lithium-ion batteries

Lithium-ion batteries may vent explosively if damaged. The escaping gas mixture may ignite.

- Observe the safety instructions provided by the battery manufacturer.

7. Connect the black cable of the e-MOVEKIT to the negative terminal of the battery.
8. Connect the red cable of the e-MOVEKIT to the positive terminal of the battery.
9. If the drive command is given via CANopen, connect the CAN-dongle to the D-SUB 9 connector on the side of the device. If the dongle is connected directly to the e-MOVEKIT, add a 120 Ω resistor between CAN Hi and CAN Low.

6.2 System Integration e-MOVEKIT

Required tools

- hex key, 4 mm and 5 mm
- torque wrench, 1 Nm to 10 Nm

Electrical connection

1. Open the motor terminal box cover.
2. Connect motor phase terminals U, V, and W with the motor power cables and secure with the supplied washers and nuts ➤35|21. Tighten the nuts. Torque: 4.6 Nm to 5.6 Nm

9 Connect motor phase terminals with the motor power cables

001C4B3A

3. Close the motor terminal box cover. Tighten all nuts. Torque: 2.5 Nm to 3.5 Nm
4. Tighten the 3 cable glands on the motor terminal box. Torque: max. 1.5 Nm
5. Connect the motor power cables to the corresponding terminals of the controller (Curtis AC F2-A), following the instructions in the manufacturer's user manual.
6. Connect the battery to the controller, following the instructions in the manufacturer's user manual.
   Insert a main interlock relay between the positive connection from the battery to the controller ➤34|19.
7. For feedback and EM brake control, connect the DEUTSCH DT04-08PA interface with the corresponding pins of the 23-pin AMPSEAL connector ➤35|20.

Low current connections

All logic and low current connections are made via a 23-pin AMPSEAL connector with gold-plated pins. The wire silos of the matching AMPSEAL socket are sealed with a diaphragm.

8. Insert individual wires to pierce the diaphragm. To maintain protection class IP65, use only wires and plugs suitable for water exposure and outdoor use.
9. Pins where the silo-diaphragm has been pierced but are not in use must be sealed with specific AMPSEAL sealing plugs.

3 Components and part numbers of the AMPSEAL connectors

Compatible 23-pin AMPSEAL components	Part number
AMPSEAL receptacle housing (black vehicle harness connector)	770680-1
Gold-plated socket terminals for the connector (strip form p/n)	770520-3
Gold-plated socket terminals for the connector (loose piece p/n)	770854-3
Silo seal plugs for unused pin positions with a pierced diaphragm	770678-1
Wire size, cable harness	0.5 mm^2 ... 1.25 mm^2 (20 to 16 AWG)
Wire diameter (wire with thin-wall insulation)	1.7 mm ... 2.7 mm
Hand crimper for the cable harness sockets	58440-1

For AMPSEAL components and tools, see application specification 114-16016 by TE Connectivity. For further information, please contact the manufacturer.

The 23-pin AMPSEAL connector can be ordered preconfigured.
Order code: ZKA-377944

Further information

VP-10005-EN | F Series Motor Controller |
https://www.schaeffler.de/std/220A

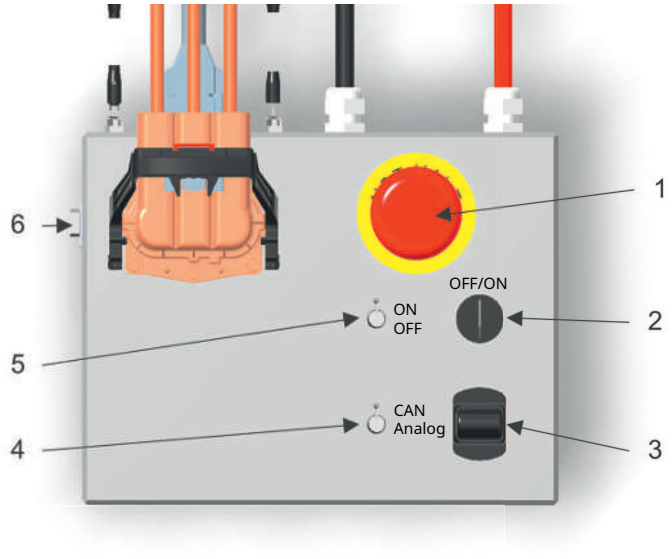
7 Operation

The e-MOVEKIT can be operated either via an analog voltage throttle signal or a throttle command via CANopen. Depending on the operating mode, a specific start-up sequence must be followed. The Quick Start e-MOVEKIT may only be operated under laboratory conditions. The primary purpose of the Quick Start e-MOVEKIT is initial prototype testing.

7.1 Operation of the Quick Start e-MOVEKIT with joystick

Control elements and inputs

10 Control elements and inputs



1	Emergency stop	2	Key-switch
3	Joystick	4	CAN/analog switch
5	Interlock	6	CAN connection (D-Sub 9)

Operation

⚠ CAUTION

Risk of injury due to actuator movement

During commissioning, the actuator may move. There is a risk of injury in the actuator's range of motion.

- Ensure that no people or objects are in the vicinity of the linear actuator or application during commissioning and operation.

⚠ CAUTION

Risk of injury due to actuator movement

The limit switches are preconfigured for the actuator. Changing their position on the linear actuator results in a loss of function. This may cause the actuator to move unexpectedly.

- Only perform limit switch position changes and teach-in new positions when the actuator is not in operation.

✓ Emergency stop deactivated

✓ Interlock in OFF position

✓ Key-switch in OFF position

✓ CAN/analog switch in Analog position

1. Turn the key-switch to ON.

› The power supply of the e-MOVEKIT is activated.

2. Wait until the control unit has been extended. This takes a maximum of 5 seconds.

3. Turn the interlock to ON.

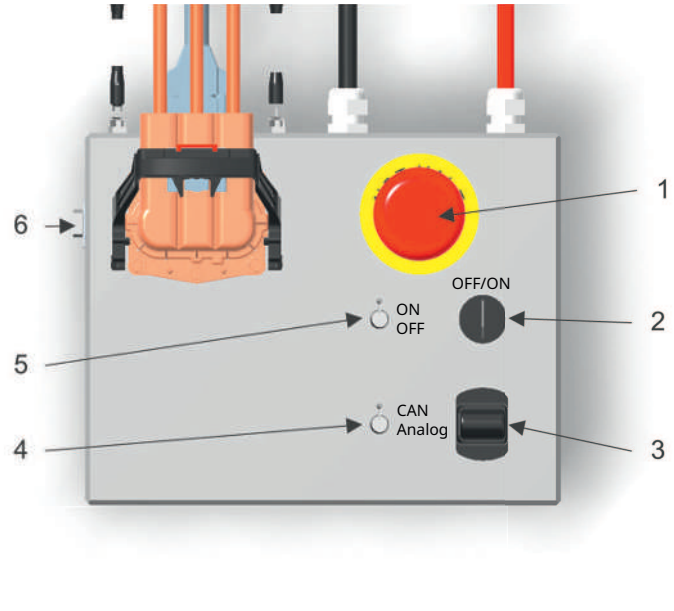
› The interlock sends a command to the controller to close the main contactor. The actuator can only be operated once the main contactor has successfully closed.

» The e-MOVEKIT is now ready for operation.

7.2 Operation of the Quick Start e-MOVEKIT with CAN commands

Control elements and inputs

11 Control elements and inputs



1	Emergency stop	2	Key-switch
3	Joystick	4	CAN/analog switch
5	Interlock	6	CAN connection (D-Sub 9)

Nomenclature

A hexadecimal value, e.g. 80000226h, is written as 0x80000226. All digits after the x are hexadecimal values.

If the throttle mode is changed from Analog to CAN or vice versa while the e-MOVEKIT is in operation, an error occurs and actuator movement is stopped immediately.

Change programming sequence: This sequence must only be followed when switching from Analog to CAN or vice versa.

Operation

✓ Emergency stop deactivated

✓ Interlock in OFF position

✓ Key-switch in OFF position

✓ CAN/analog switch in Analog position

1. Connect the CAN-dongle (e.g., Kvaser Leaf Light 2) to the Quick Start e-MOVEKIT box and the computer.

CAN baud rate: 250 Kbit/s

CAN node ID: 26 h

2. Turn the key-switch to ON.
3. Set the CAN/Analog switch to CAN.

› An error is triggered.

4. Acknowledge the error by switching the main power supply off and back on again. To do this, turn the key-switch to OFF and then back to ON.
5. Turn the interlock to ON.
6. Acknowledge the error by switching the main power supply off and back on again.
7. Turn the key-switch to OFF and then back to ON.
8. Switch the controller from the pre-operation state to the operational state.

The following message switches the controller from the pre-operation state to the operational state:

4 Message

CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0h	2h	1h	26h	–	–	–	–	–	–

Byte 0: 1h – Switch to operational state

Byte 0: 80h – Switch to pre-operation state

Byte 1: 26h – Node ID

When the controller is switched to operational state, a cyclic throttle command is expected. If no throttle signal is sent to the controller, an error state is triggered after 40 ms.

9. Send a cyclic throttle command to the controller. If no movement is intended, send a throttle command with 0 % to the controller. Send throttle signal at fixed intervals of 20 ms.

The following message is used for the throttle command:

5 Message

CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
226h	2h	00h	00h	–	–	–	–	–	–

CAN-ID: RPDO for Node ID 26h (COB ID)

Byte 0: Throttle command in %

Byte 1: Throttle command in %

The following table can be used as a reference. Little endian is used.

6 Throttleposition for actuator movement

Throttle CMD	HEX	Byte 0	Byte 1	Actuator movement
–100 %	0x8000	00h	80h	Retract v = 100 %
–80 %	0x999A	9Ah	99h	Retract v = 80 %
–60 %	0xB333	33h	B3h	Retract v = 60 %
–40 %	0xCCCD	CDh	CCh	Retract v = 40 %
–20 %	0xE667	67h	67h	Retract v = 20 %
0 %	0x0000	00h	00h	Stop, no movement
20 %	0x1999	99h	19h	Extend v = 20 %
40 %	0x3333	33h	33h	Extend v = 40 %
60 %	0x4CCD	CDh	4Ch	Extend v = 60 %
80 %	0x6666	66h	66h	Extend v = 80 %
100 %	0x7FFF	FFh	7Fh	Extend v = 100 %

7.3 Changing the motor speed of the Quick Start e-MOVEKIT

WARNING

Failure of the safety shutoff due to excessive linear unit speed

If the linear unit speed is set above 90 mm/s, the actuator or the application may impact the mechanical end-stop, as the limit switches are no longer detected and the actuator can no longer be stopped. This creates a risk of injury in the actuator's range of motion.

- Ensure that the linear unit speed does not exceed 90 mm/s.

NOTICE

Reduced performance of the centrifugal brake due to excessive motor speed

For actuators with a centrifugal brake, the motor speed is limited by the engagement speed of the centrifugal brake. If the maximum motor speed is higher than the engagement speed of the centrifugal brake, the centrifugal brake is activated at high linear unit speeds. The actuator motor speed is reduced. This is considered improper use and leads to a reduction in the performance of the centrifugal brake.

- Operate the actuator within the permissible speed ranges only.

NOTICE

Damage to the electromechanical brake due to excessive motor speed

The maximum permissible motor speed for the electromechanical brake mounted at the rear of the N11 motor is 3000 min^{-1}. Operating the motor at higher speeds leads to permanent damage and is prohibited.

- Operate the motor within the permissible speed ranges only.

The e-MOVEKIT prevents the maximum input speed being set above 3000 min^{-1} or below 100 min^{-1}.

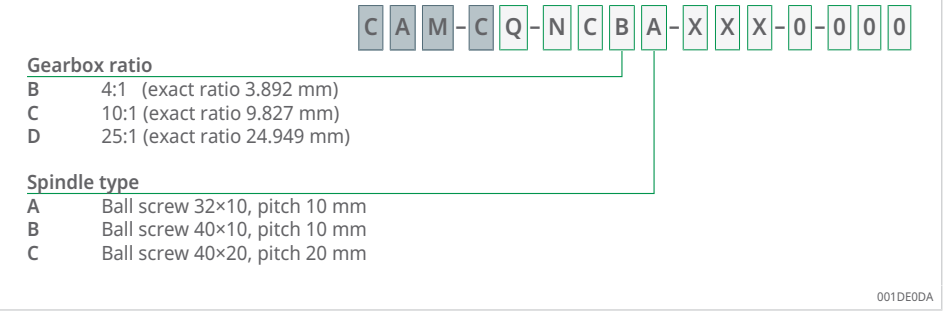
The factory preconfigured maximum speed of the linear unit can be changed via a CAN command. The actuator speed is subject to certain physical limits. When the motor speed changes (min^{-1}), the speed of the linear unit also changes. The motor speed can be calculated using the following formula:

f 1

$$n = \frac{v \cdot i_{ex}}{P} \cdot 60$$

i_{ex}	–	Exact gearbox ratio
n	min^{-1}	Engine speed
P	mm	Pitch of the threaded spindle
v	mm/s	Linear speed

12 Pitch and gearbox ratio in the order code



7

7.3.1 Setting the maximum motor speed

1. Calculate the maximum motor speed ➤21|1.
2. Turn the key-switch to ON.
3. Send the calculated motor speed via CAN.

7 Message

CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
426h	2h	XXh	XXh	–	–	–	–	–	–

CAN-ID: RPDO for Node ID 26h (COB ID)

Byte 0 to 1: maximum motor speed in min^{-1}

Example:

set new maximum motor speed to 1150 min^{-1} 0x047E

8 Message

CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
426h	2h	7Eh	04h	–	–	–	–	–	–

4. Save new maximum motor speed.

9 Message

CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
326h	4h	73h	61h	76h	65h	–	–	–	–

CAN-ID: RPDO for Node ID 26h (COB ID)

Byte 0 to 3: represents “save” in hexadecimal values

5. Turn the key-switch to OFF.
6. Turn the key-switch to ON.

» The new maximum motor speed is activated.

7.3.2 Resetting the motor speed to factory setting

1. Turn the key-switch to ON.
2. Send command via CAN.

▦10 Message

CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
326h	4h	66h	72h	65h	73h	–	–	–	–

CAN-ID: RPDO for Node ID 26h (COB ID)

Byte 0 to 3: represents “fres” in hexadecimal values

3. Turn the key-switch to OFF.
4. Turn the key-switch to ON.

» The motor speed is reset.

7.4 Operation of the Quick Start e-MOVEKIT with analog throttle input

Hardware inputs

Refer to the wiring diagram ➤34 | 19.

For the controller to function, all inputs and outputs of the motor controller must be wired. The controller automatically detects missing components and triggers an internal error that prevents any interaction.

The main contactor must be a coil-based contactor. Other types of main contactors are not compatible with the controller. Schaeffler recommends the CURTIS/ALBRIGHT RU80 contactor.

Operation

⚠ CAUTION

Risk of injury due to actuator movement

During commissioning, the actuator may move. There is a risk of injury in the actuator’s range of motion.

- Ensure that no people or objects are in the vicinity of the linear actuator or application during commissioning and operation.

✓ Emergency stop deactivated

✓ Interlock in OFF position (B+ to AMPSEAL J1-8 open)

✓ Key-switch in OFF position (B+ to AMPSEAL J1-1 open)

✓ No drive command may be issued to the controller, AMPSEAL J1-10 must read DC 2.5 V ±10 %.

1. Turn the key-switch to ON (B+ to AMPSEAL J1-1 closed).

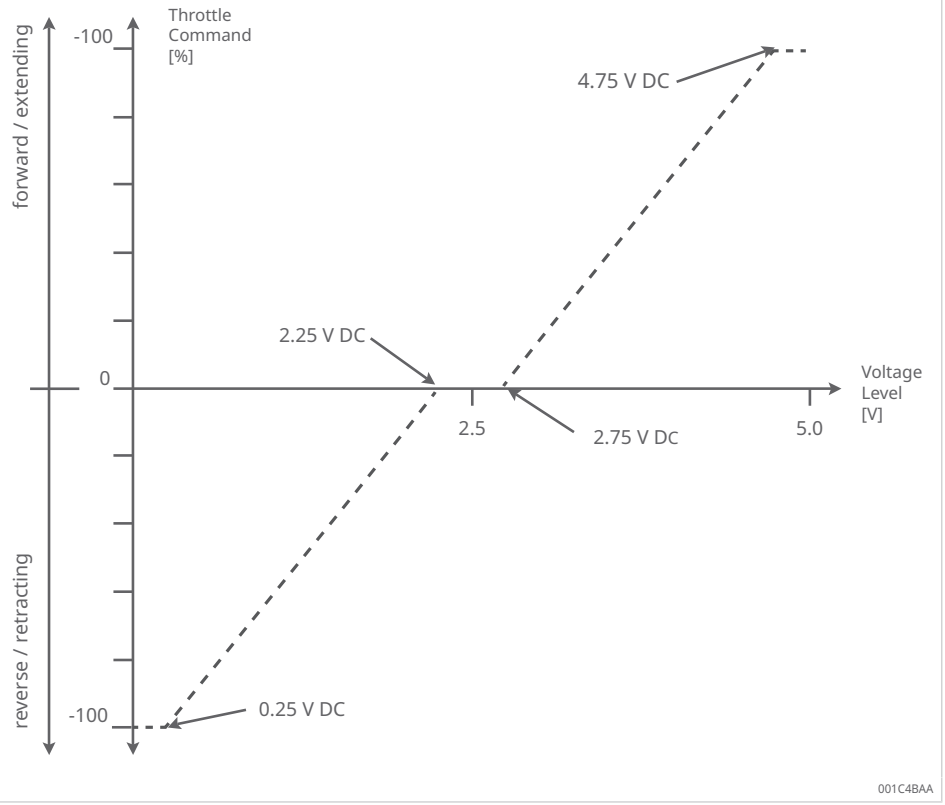
› The power supply of the e-MOVEKIT is activated.

2. Wait 10 seconds until the controller has booted up.
3. Turn the interlock to ON (B+ to AMPSEAL J1-8 closed).

› The e-MOVEKIT is now ready for operation.

4. Apply voltage to AMPSEAL J1-10 to control actuator movement.

13 Voltage level at input and resulting throttle command



Limit switch position

If the System Integration e-MOVEKIT is ordered with the limit switch option enabled, connect the limit switches according to the wiring diagram ➤34|19.

⚠ WARNING

Risk of injury due to actuator movement

The mechanical end stops are not designed for regular impacts. If the limit switches are not configured correctly, the actuator in the application may reach the mechanical end stops.

- Ensure that the limit switches are correctly configured.
- Ensure that the actuator and the application in which it is installed do not reach the mechanical end stops.

11 Sensor input

Sensor input	Function	Installation
AMPSEAL J1-15	Sensor input Extended – Stop Stops the actuator completely when it is in the fully extended position. Only reverse movement (retraction) is possible.	The sensor must be mounted 3 mm before the mechanical end-stop at the front of the fully extended actuator, either on the actuator or on the application.
AMPSEAL J1-14	Sensor input Extended – Slow Down Slows actuator movement in the extending direction to 10 % of the requested throttle. The retracting speed is not affected by the speed reduction.	The sensor must be mounted at least 30 mm before the mechanical end-stop at the front of the fully extended actuator, either on the actuator or on the application.
AMPSEAL J1-23	Sensor input Extended – Stop Stops the actuator completely when it is in the fully retracted position. Only reverse movement (extension) is possible.	The sensor must be mounted 3 mm mm before the mechanical end-stop at the underside of the fully retracted actuator, either on the actuator or on the application.
AMPSEAL J1-22	Sensor input Extended – Slow Down Slows actuator movement in the retracting direction to 10 % of the requested throttle. The extending speed is not affected by the speed reduction.	The sensor must be installed at least 30 mm before the mechanical end-stop at the underside of the fully retracted actuator, either on the actuator or on the application.

7.5 Operation of the Quick Start e-MOVEKIT with CAN commands

For the controller to function, all inputs and outputs of the motor controller must be wired. The controller automatically detects missing components and triggers an internal error that prevents any interaction.

The main contactor must be a coil-based contactor. Other types of main contactors are not compatible with the controller. Schaeffler recommends the CURTIS/ALBRIGHT RU80 contactor.

If the throttle mode is changed while the system is in operation, an error occurs. Actuator movement is stopped immediately.

Refer to the wiring diagram ➤34 | 19.

The System Integration e-MOVEKIT is preconfigured for operation with analog throttle commands. To switch to control with CAN commands, a switching command must be sent to the controller.

Changing the programming sequence

This sequence must only be followed when switching from Analog to CAN or vice versa.

✓ CAN interface connected

✓ Emergency stop deactivated

✓ Interlock in OFF position

✓ Key-switch in OFF position

1. Turn the key-switch to ON.
2. Connect to the CAN interface.
3. Send the following command to the controller. An error is triggered.
4. Turn the key-switch to OFF and then back to ON.

› Error is acknowledged.

12 Message

CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
526h	1h	1h	–	–	–	–	–	–	–

CAN-ID: RPDO for Node ID 26h (COB ID)

Byte 0: 1 – CAN drive mode (throttle via CAN) is activated

Byte 0: 0 – Analog drive mode (throttle via voltage potential) is activated

5. Turn the interlock to ON.

› The interlock sends a command to the controller to close the main contactor. The actuator can only be operated once the main contactor has successfully closed.

6. Switch the controller from the pre-operation state to the operational state with the following message:

13 Message

CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0h	2h	1h	26h	–	–	–	–	–	–

Byte 0: 1h – Switch to operational state

Byte 0: 80h – Switch to pre-operation state

Byte 1: 26h– Node ID

When the controller is switched to operational state, a cyclic throttle command is expected. If no throttle signal is sent to the controller, an error state is triggered after 40 ms.

7. Send a cyclic throttle command to the controller. If no movement is intended, send a throttle command with 0 % to the controller. Send throttle signal at fixed intervals of 20 ms.

The following message is used for the throttle command:

14 Message

CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
226h	2h	00h	00h	–	–	–	–	–	–

CAN-ID: RPDO for Node ID 26h (COB ID)

Byte 0: Throttle command in %

Byte 1: Throttle command in %

The following table can be used as a reference. Little endian is used.

15 Throttleposition for actuator movement

Throttle CMD	HEX	Byte 0	Byte 1	Actuator movement
–100 %	0x8000	00h	80h	Retract v = 100 %
–80 %	0x999A	9Ah	99h	Retract v = 80 %
–60 %	0xB333	33h	B3h	Retract v = 60 %
–40 %	0xCCCD	CDh	CCh	Retract v = 40 %
–20 %	0xE667	67h	67h	Retract v = 20 %
0 %	0x0000	00h	00h	Stop, no movement
20 %	0x1999	99h	19h	Extend v = 20 %
40 %	0x3333	33h	33h	Extend v = 40 %
60 %	0x4CCD	CDh	4Ch	Extend v = 60 %
80 %	0x6666	66h	66h	Extend v = 80 %
100 %	0x7FFF	FFh	7Fh	Extend v = 100 %

7.6 Sending mailbox messages

After the controller has been switched to operational state (➤23|7.4/ ➤25|7.5), the controller sends cyclic messages containing key information about the controller and the motor:

- Format: Little endian
- Frequency: cyclic at 40 ms intervals

Transmit TPDO1

Transmit TPDO1 sends key information about the motor:

- motor speed
- motor temperature
- root mean square value
- current

The following table can be used as a reference:

16 Message

CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
1A6h	6h	Motor speed		Motor temperature		Current RMS		–	–

17 Motor speed

Information	Rotating speed of motor shaft
Data type	Integer 16
Unit	min^{-1}

18 Motor temperature

Information	Motor temperature from integrated temperature sensor (near the stator windings)
Data type	Integer 16
Unit	°C/10

19 Current RMS

Data type	Unsigned 16
Unit	A/10

Transmit TPDO2

Transmit TPDO2 sends key information about the controller:

- battery voltage level (capacitor voltage)
- battery current
- controller temperature
- state of the main capacitor relay (main switch)

The following table can be used as a reference:

20 Message

CAN-ID	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
2A6h	7h	Capacitor voltage		Battery current		Controller temperature		Main state	–

21 Capacitor voltage

Information	Battery voltage level at B+ of the controller
Data type	Unsigned 16
Unit	V/100

22 Battery current

Information	Current drawn from the battery by the controller
Data type	Integer 16
Unit	A/10

23 Controller temperature

Information	Temperature of the motor controller.
Data type	Integer 32
Unit	°C/10

The controller automatically shuts down when it reaches its maximum operating temperature under continuous load.

24 Main state

Information	Status of the main contactor relay	
Data	**State**	**Description**
	0	open
	1	precharge
	2	weld check
	3	missing check
	4	closed
	5	deceleration
	6	arc check
	7	open delay
	8	weld check
	9	malfunction
	10	closed (when main activation is OFF, not configured for e-MOVEKIT)

The main state of the main contactor relay is a simple reference point for the state of the controller and is useful for troubleshooting. For further information, refer to the manufacturer's user manual.

Further information

VP-10005-EN | Series F Motor Controller |
https://www.schaeffler.de/std/220A

7.7 Manual release on the electromagnetic brake

⚠ WARNING

Risk of injury during manual release due to failure of the electromagnetic brake

Opening the manual release or the motor's electromagnetic brake can lead to system failure.

- Do not open the manual release or the motor's electromagnetic brake if the actuator is under load.
- Open the manual release or the motor's electromagnetic brake only if a centrifugal brake is mounted on the gearbox. The centrifugal brake limits the failure speed to a safe level.
- Ensure that no people or objects are in the vicinity of the actuator or the application.

⚠ WARNING

Risk of injury in the actuator's range of motion due to motor failure

If the motor is no longer supplied with power, the actuator cannot brake or stop at the limit switch positions.

- Ensure that the mechanical end stops are not contacted during manual release.

If the manual release is opened while the motor is supplied with power, the controller attempts to hold the motor position and counteracts the torque generated by the actuator.

If the actuator is under load, the actuator can move slightly in the load direction.

To enable the operation of the centrifugal brake for a manual emergency lowering of the actuator load, the main contactor must be opened by setting the interlock to OFF (➤34|19/ ➤13|8).

If the actuator is moved while the controller is still switched on, an unintended movement error is triggered. To acknowledge the error, switch the device off and back on again. If the controller was switched off during the movement, this action is not required.

8 Troubleshooting

25 Troubleshooting

Error	Possible cause	Remedy
The actuator does not move.	Controller not ready for operation	Check the battery power supply to the controller.
		Check the connections to the motor.
		The actuator is in an extreme position that prevents further retraction or extension. Move the actuator in the opposite direction.
	Interlock is not closed, fault state is active	Switch the power supply off with the key-switch and then back on again.
		Control mode CAN/analog was changed during operation. Switch the power supply off and then back on again.
		Check the connections between the controller and the motor (U V W and encoder/ motor temperature sensor).
	Sensor signal is activated (AMPSEAL J1-15, AMPSEAL J1-23)	Check the sensor signal. If the actuator is not in its extreme position, do not send a sensor signal to the motor controller.
	Electromagnetic brake on the motor does not open	Check all connections between the controller and the motor.
	Controller not in operational state	Ensure that the controller is switched from the pre-operation state to the operational state via the corresponding CAN command.
		The throttle signal timeout was triggered due to the absence of a continuous throttle command via CAN. Switch the controller back to pre-operation state (➤19|7.2/ ➤23|7.4).
The actuator only moves slowly.	Loads on the actuators are too high	Remove the load from the system and test again with a lighter load.
	Sensor signal is activated (AMPSEAL J1-14, AMPSEAL J1-22)	Check the sensor signal. If the actuator is not near its extreme position, do not send a sensor signal to the motor controller.
The actuator does not automatically stop or slow down before reaching its extreme positions.	Sensor not configured	Repeat the teach-in process for the limit switches. For further information, refer to the EMA-100 user manual.
	Sensor not connected to the controller	Connect the limit switch sensors to the controller in accordance with the wiring diagrams.

Further information

BA 108 | High-Performance Actuators | Electro-Actuator EMA-100 | https://www.schaeffler.de/std/2028

9 Technical data

26 Performance data Quick Start e-MOVEKIT

Designation	Symbol	Unit	Values
Controller type	–	–	Curtis AC F2-A 24-200-051
Locking mechanism	–	–	Integrated
Nominal voltage range	U_n	–	24
Minimum voltage	U_{min}	V	12
Burnout voltage	U_{burn}	V	8
Maximum voltage	U_{max}	V	30
Maximum current [S2-2 min]	I_{max} (S2 - 2 min)	A RMS	200
Maximum current [S2-60 min]	I_{max} (S2 - 60 min)	A RMS	67
Storage ambient temperature	ϑ_{stor}	°C	−40 ... +95
Operation ambient temperature	ϑ_{op}	°C	−10 ... +40
Designed life	–	h	8000
Overcurrent protection (safety fuse)	–	–	250
Ingress protection class	–	–	IP65/IP67

27 Performance data System Integration e-MOVEKIT

Designation	Symbol	Unit	Value
Controller type	–	–	Curtis AC F2-A 24-200-051
Nominal voltage range	U_n	–	24
Minimum voltage	U_{min}	V	12
Burnout voltage	U_{burn}	V	8
Maximum voltage	U_{max}	V	30
Maximum current [S2-2 min]	I_{max} (S2 - 2 min)	A RMS	200
Maximum current [S2-60 min]	I_{max} (S2 - 60 min)	A RMS	67
Storage ambient temperature	ϑ_{stor}	°C	−40 ... +95
Operation ambient temperature	ϑ_{op}	°C	−40 ... +50
Designed life	–	h	8000
Ingress protection class	–	–	IP65/IP67

9.1 Ambient conditions

Transport and storage

Transport and store the product exclusively in its original packaging under the following ambient conditions:

- chemically non-aggressive environment
- no mechanical shocks

Operation

Operate the product exclusively under the following ambient conditions:

- temperature
  - Quick Start e-MOVEKIT: from −10 °C to +40 °C
  - System Integration e-MOVEKIT: from −40 °C to +50 °C
- humidity up to 95 %, non-condensing

9.2 Type plate

Quick Start e-MOVEKIT

The type plate is located on the control box.

14 Type plate for Quick Start e-MOVEKIT

001C4ABA

1	Order code	2	Operating voltage and maximum operating current
3	Serial number	4	Date of manufacture
5	Bar code for designation	6	Bar code for serial number

System Integration e-MOVEKIT

The type plate is located on the packaging.

15 Type plate for System Integration e-MOVEKIT

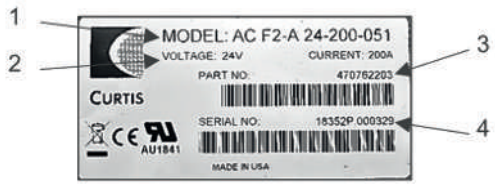
001C4AD4

1	Order code	2	Operating voltage and maximum operating current
3	Serial number	4	Date of manufacture
5	Bar code for designation	6	Bar code for serial number

Controller

The manufacturer's type plate is located on the controller.

16 Type plate for controller



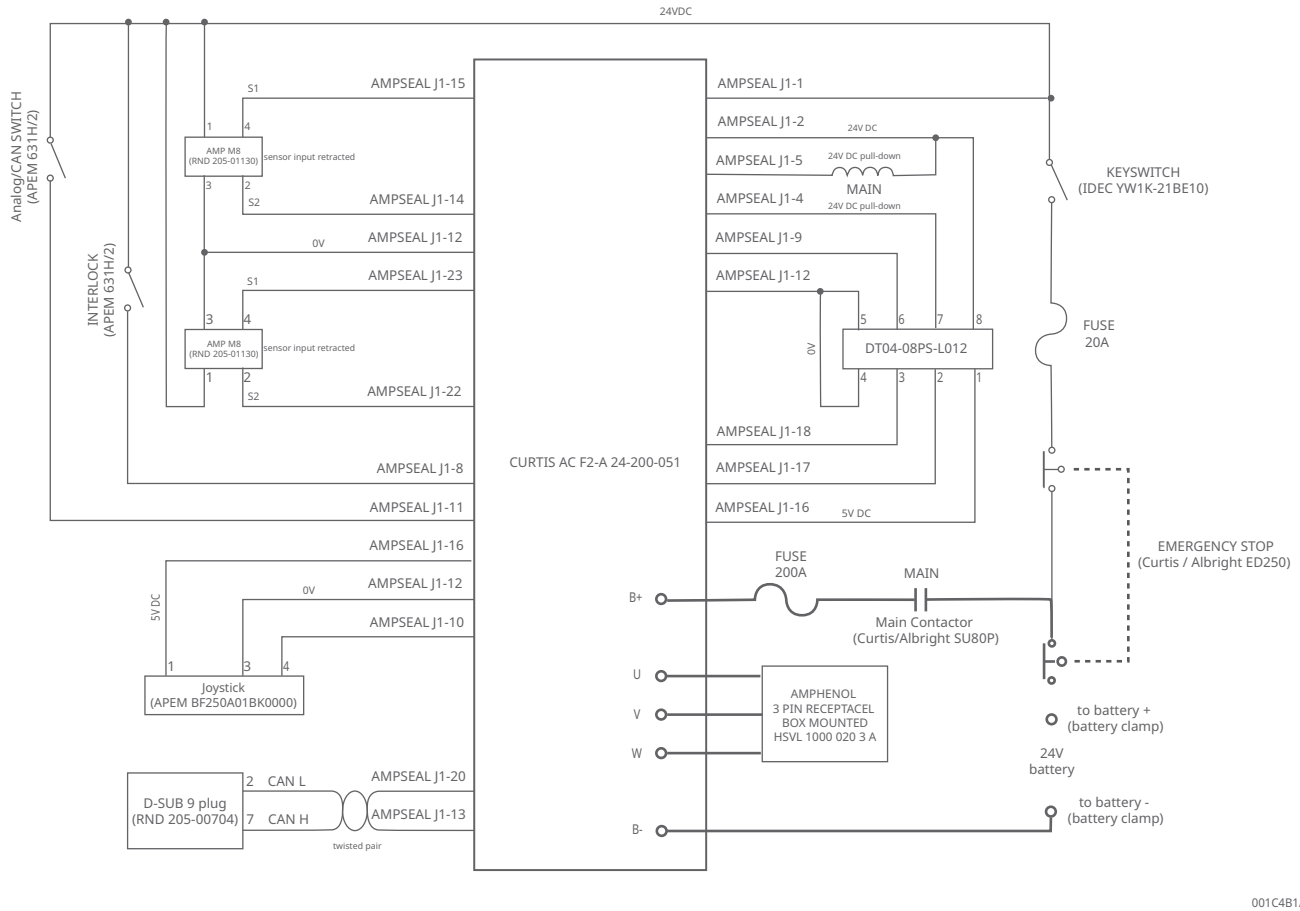
001C4AFA

1	Model designation	2	Operating voltage and maximum operating current
3	Part number	4	Serial number

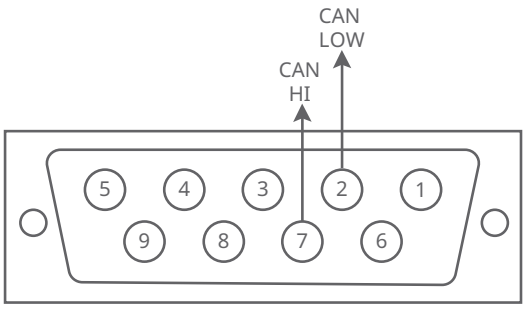
9.3 Wiring diagrams

Quick Start e-MOVEKIT

17 Wiring diagram for Quick Start e-MOVEKIT



18 D-SUB 9 for CAN pin assignment



System Integration e-MOVEKIT

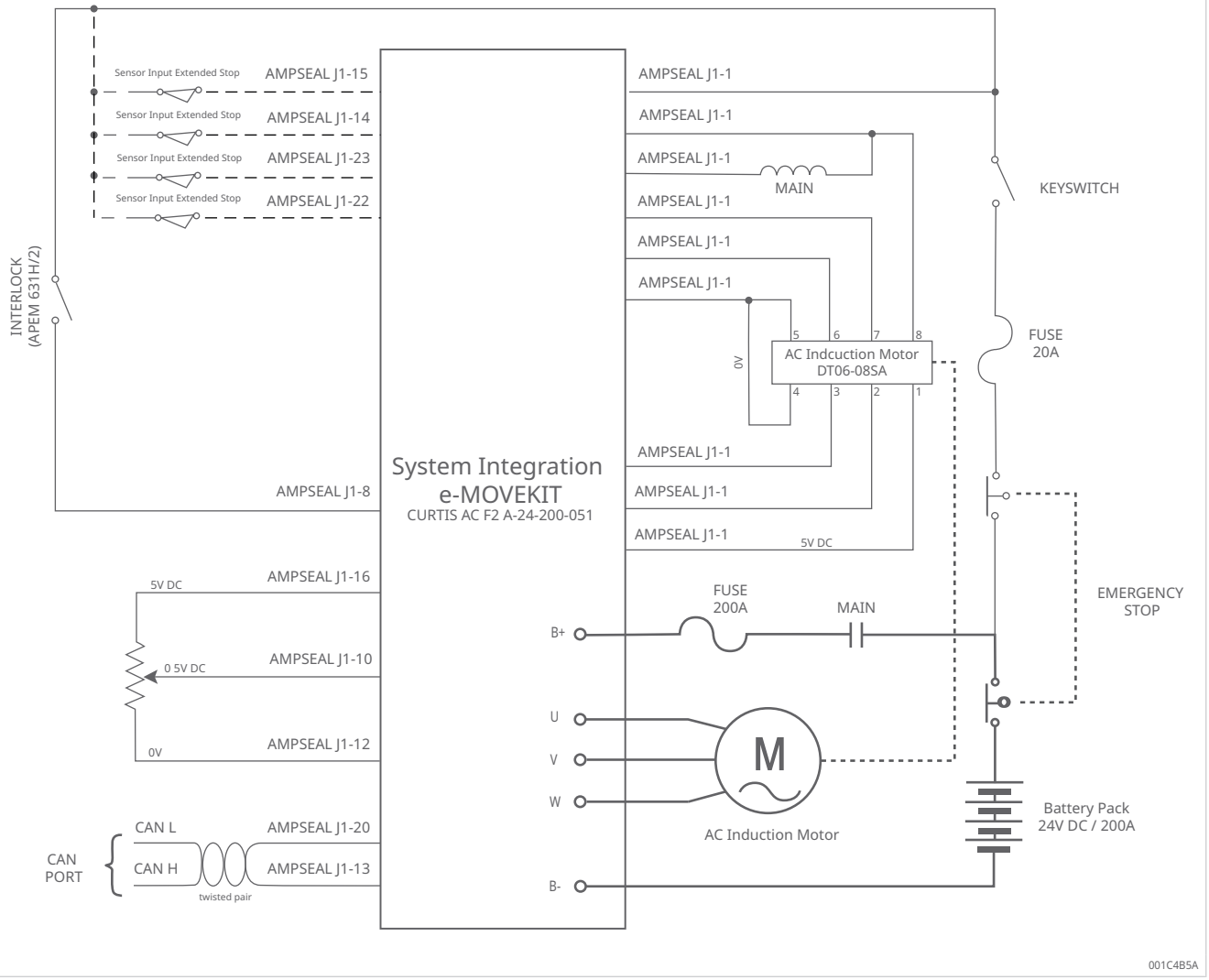
The wiring diagrams show the electrical configuration of the controller and the preconfiguration carried out by Schaeffler. When using the preconfigured firmware, refer to the following wiring diagram for the respective controller.

The I/O assignment of the controller and its functions can be adapted in accordance with the manufacturer's user manual VP-10005-EN F Series Motor Controller. In this case, the wiring diagrams and pin assignments shown here are no longer valid.

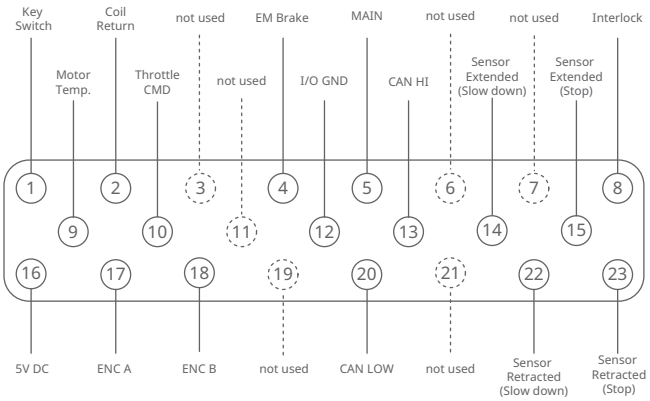
Further information

VP-10005-EN | F Series Motor Controller |
https://www.schaeffler.de/std/220A

19 Wiring diagram for System Integration e-MOVEKIT



20 Pin assignment for 23-pin AMPSEAL connector



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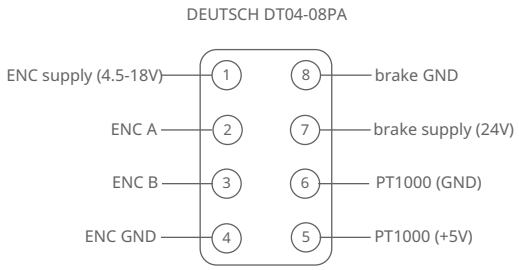
9

Further information

N11 motor interface

21 Pin assignment for N11 motor interface



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