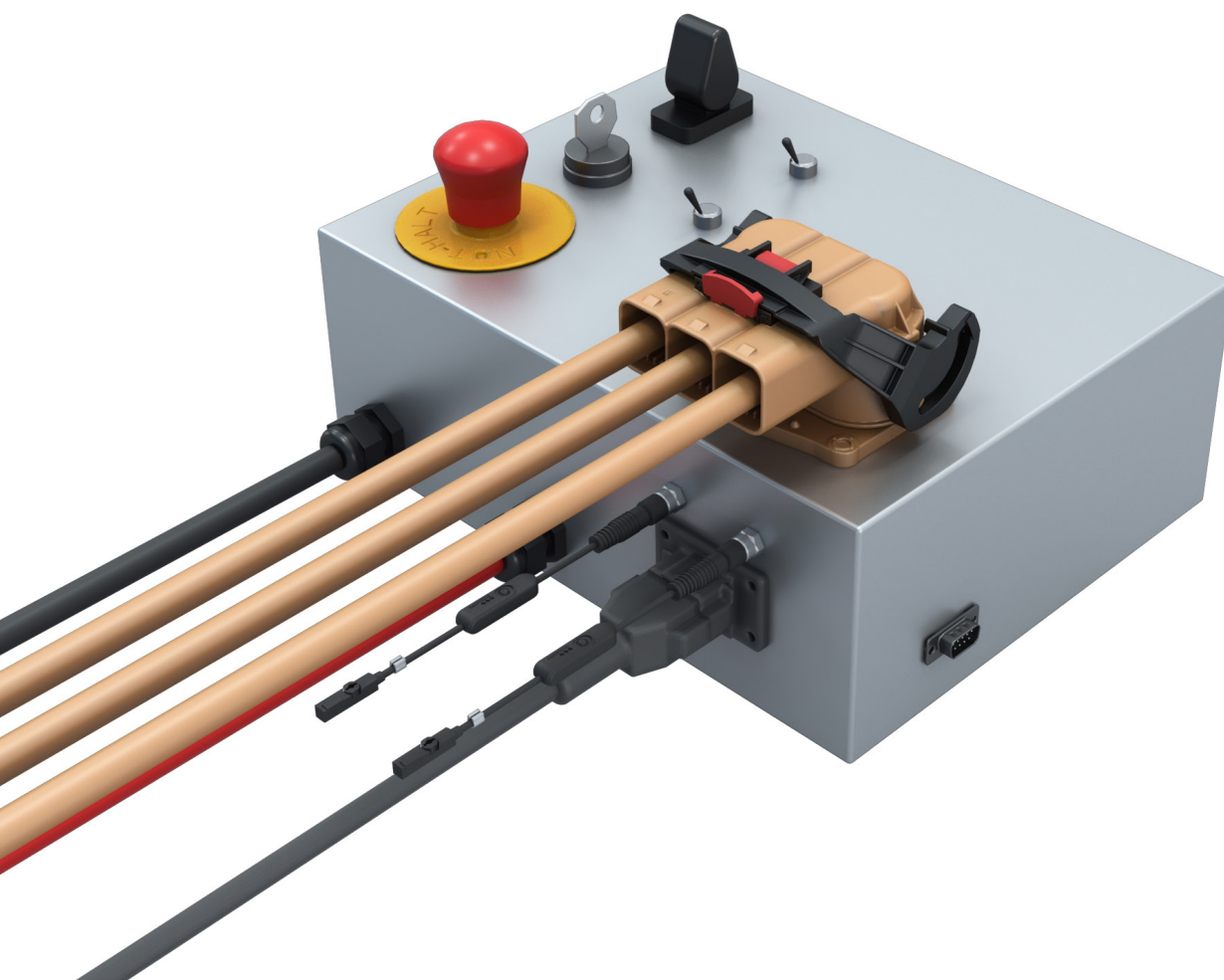


EWELLIX

A Schaeffler Company

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

e-MOVEKIT



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1. General information

1.1 Information in this manual

This manual provides important information on how to work with the actuator (also called device or drive) safely and efficiently.

The manual is part of the device, must always be kept in the device's direct proximity and should be available for personnel to read at any time. All personnel working with the device must read and understand this manual before starting any work. Strict compliance with all specified safety notes and instructions is a basic requirement for safety at work.

Moreover, the accident prevention guidelines and general safety regulations applicable at the place of use of the device must also be complied with.

For a better representation of the circumstance of use, the illustrations used are not necessarily to scale and may vary from the actual design of the device.

1.2 Explanation of symbols and signal words

Safety precautions

Safety precautions are identified by symbols and signal words as shown to the right. The signal words indicate the severity of the hazard and the chance it could occur.

Follow these safety precautions and act cautiously in order to avoid accidents, personal injury and damage to property.

The installation instructions describe the setup and operation of e-MOVEKIT, a external motor controller for EMA-100 actuators equipped with a motor option N11.

DANGER

Indicates a dangerous situation, which will lead to death or serious personal injury, if the precautionary measures are ignored.

WARNING

Indicates a dangerous situation, which can lead to minor or moderate injury or property damage, if the precautionary measures are ignored.

CAUTION

Indicates a dangerous situation, which can lead to minor or moderate injury the precautionary measures are ignored.

NOTICE

Indicates information considered important, but not hazard-related (e.g. messages relating to property damage).

NOTE

Emphasizes useful hints and recommendations as well as information for efficient and trouble-free operation.

The e-MOVEKIT contains of a controller and additional cables to connect to the motor. The motor needs to be ordered together with the complete actuator separately using the EMA-100 type key.

		C	A	M	-	C	Q	-	N	C	B	A	-			-	0	-	0	0	0
Type																					
Q	Quick start e-MOVEKIT (including cables, sensors) ¹⁾																				
S	System integration e-MOVEKIT (excluding cables)																				
Motor type																					
N	Nidec AC induction motor, 1.4kW, with EM-brake																				
Gearbox Size																					
C	Small Parallel Gear																				
Gearbox Ratio																					
B	4:1 (spur only)																				
C	10:1 (spur only)																				
D	25:1 (spur only)																				
Screw Type																					
A	Ball screw 32x10																				
B	Ball screw 40x10																				
C	Ball screw 40x20																				
Speed																					
Linear Unit speed in mm/s ²⁾																					
Other options - Sensor																					
0	No sensor integration																				
1	integrated magnetic limit switches (automatically selected with quick start e-MOVEKIT)																				
Customer option																					
000	No option																				

For general information and safety instruction please refer to installation, operation and maintenance manuals available on www.ewellix.com

Qualified personnel is able to carry out assigned work and to recognize and prevent possible dangers self-reliantly due to its professional training, knowledge and experience as well as profound knowledge of application regulations.

VP-10005-EN-Manual
F Series Motor Controller

2. Safety

This section provides safety aspects supplementary to the safety aspects described in the relevant operating manuals of the included devices. Failure to comply with the guidelines and safety instructions contained in this manual may result in serious hazards that could cause possible serious injury or death, or damage to the device or equipment.

The listed safety aspects must be reviewed and taken into account in the final application risk assessment prior to the use of the e-MOVEKIT (especially in combination with the EMA-100 actuator).

2.1 Intended use

e-MOVEKIT has been designed and built for the intended use as described in the operating manual of the EMA-100 actuator. The actuator is design to perform a linear movement with a defined stroke, force and speed inside an application.

The Quick Start e-MOVEKIT is intended to be used under lab conditions and is only deemed to be used for prototype builds. It is not intended to be used as the primary control device for any application.

The System Integration e-MOVEKIT is intended to be used as the control device for one actuator inside the application. The e-MOVEKIT is intended to control the movement of the actuator by a defined motor speed resulting in a defined linear unit speed within a defined range of motion.

Any use that extends beyond the intended use or a use different than the one described inside this operating manual is deemed misuse.

Any type of claims resulting from damage caused by misuse are excluded.

2.2 Functional safety

The e-MOVEKIT and its components Quick Start e-MOVEKIT or System Integration e-MOVEKIT and EMA-100 actuator, are not functional safety systems compliant with EN ISO 13489-1 or IEC 62061. A safety evaluation on system level needs to be performed by the end-user / integrator.

2.3 Safety mechanisms

The following measures have been integrated into the e-MOVEKIT to reduce the risk of harm or damage

- The individual components have been designed according to DIN EN 60204-1.
- The motor has an integrated electromechanical brake that prevents back-driving in case of power loss.
- The controller implements several safety features that prevent actuator movement in case safety critical criteria are not met (e.g. open power wires, motor encoder fault).
- The Quick Start e-MOVEKIT is equipped with an emergency stop button that will cut main power (from the battery) to the controller and will thereby stop the actuator movement and activate the electromechanical brake on the motor.
- The e-MOVEKIT controller checks for a CANopen connection (if configured to run on CANopen commands). In the absence of a CANopen signal the controller will stop the movement of the actuator.

2.4 Application notes

- Integration with an emergency-stop is required for its intended use. The Quick Start e-MOVEKIT comes pre-configured with such an emergency-stop.
- Install emergency stop functions for the actuator and integrate them into the safety chain of the complete system prior to operating e-MOVEKIT.
- The emergency stop function has to be connected in such a way that a disruption of the power supply or the activation of the power supply after a power disruption cannot cause a hazardous situation for persons and objects.
- The emergency-stop system must always be freely accessible.
- To integrate e-MOVEKIT into a functional safety system with a STO (Safe Torque Off) safe condition, an external safety relay must be connected to the e-MOVEKIT controller power supply, triggered by a functional safety function. This functionality is already integrated into the Quick Start e-MOVEKIT.

2.5 Potential risks

The following risks during e-MOVEKIT operation have to be considered in an application specific risk assessment.

- The actuator does not detect an impact automatically and does not stop movement upon impact. This can lead to:
 - Crushing of a person or an object in the path of the actuator or machine where the actuator is built in.
 - Dynamic impact to a person or an object causing serious injury or death or property damage
- It is possible that the actuator travel is longer than the allowed travel inside the application/machine. The actuator does not detect mechanical limits and does not stop movement upon reaching the mechanical limitations of the application/machine.
 - Potential crashes can happen at the extremities of the operating stroke of the actuator, causing significant serious injury or death or property damage.

2.6 Modification to the device

To avoid hazardous situations and to ensure optimal performance, do not make any changes or modifications to any of the hardware components unless they have been specifically authorized by Ewellix. Opening the Quick Start e-MOVEKIT is not allowed unless it has been specifically authorized by Ewellix.

2.7 Modification to the software and controller parameters

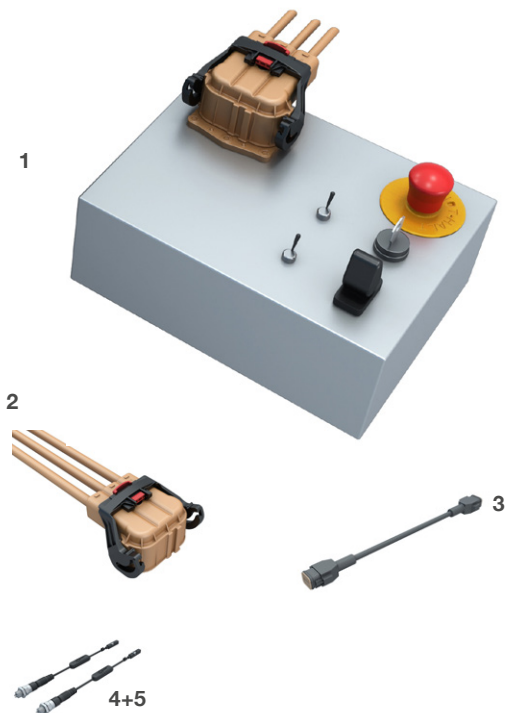
The controller comes pre-configured to work with the actuator and motor. The controller can be configured using CAN outside of what is described in this operating manual. In this case this is no longer deemed as intended use.

All modifications to the motor controller parameters done in this way need to follow the manufacturers operating manual ([VP-10005-EN-Manual F Series Motor Controller](#)) and will not be covered inside this manual.

3. e-MOVEKIT components

3.1 Scope of delivery

Quick Start e-MOVEKIT



1. Quick Start e-MOVEKIT control box
2. Motor Power Cable (pre-installed on actuator)
3. Motor Control Cable
4. Sensor Extension Cable (pre-installed on actuator)
5. Magnetic limit switch (pre-installed on actuator)

Not included, but necessary for operation



6. EMA-100 actuator* with motor option N11

* Components need to be ordered separately.

System Integration e-MOVEKIT



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

Not included, but necessary for operation



2. EMA-100 actuator* with motor option N11
3. Motor power cable 25mm² (ZKA-377947*)
4. 23pin AMPSEAL connector for I/O to motor controller (ZKA-377944*)

3.2 System requirements

- Battery power input 24V DC (max. 32V DC, min. 12V DC) at max. 200 A.
- The battery needs to be configured in a way that allows for a current flow from the controller to the battery (battery charging by the controller is necessary for regenerative braking of the motor and increases the operation time of the battery). Any other power source than a battery is not allowed and can lead to damage of the power supply.

3.3 Operating conditions

Table 1

Environment	Quick Start e-MOVEKIT Value	System Integration e-MOVEKIT Value	Unit
Temperature range	10 to +40	-40 to +50	°C
Relative atmospheric humidity, maximum (no build up condensation)	95	95	%

3.4 Product Labels

3.4.1 Quick Start e-MOVEKIT

The product label provides the following information:

Figure 1



1. Type designation (type key)
2. Operating voltage and max. operating current
3. Serial number
4. Manufacturing date box (month/year)
5. Barcode designation
6. Barcode serial number

3.4.2 System Integration e-MOVEKIT

The product label can be found on the packaging of the System Integration e-MOVEKIT controller.

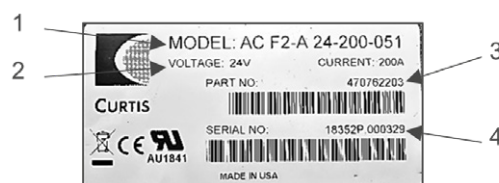
Figure 2



1. Type designation (type key)
2. Operating voltage and max. operating current
3. Serial number
4. Manufacturing date box (month/year)
5. Barcode designation
6. Barcode serial number

The product label that can be found on the controller is the manufacturers product label.

Figure 3



1. Type designation
2. Operating voltage and max. operating current
3. Part number
4. Serial number

4. Mechanical installation

For the installation of the EMA-100 actuator follow the installation instructions from the actuator operating, installation and maintenance manual.

For the installation of the System Integration e-MOVEKIT follow the installation instruction from the controller operating, installation and maintenance manual ([VP-10005-EN-Manual F Series Motor Controller](#)).

5. Electrical installation

5.1 Installation of Quick Start e-MOVEKIT

5.1.1 Tools required

The Quick Start e-MOVEKIT can be installed without the use of any additional tools. For the programming of the e-MOVEKIT, a CAN-dongle and accompanying software is recommended:

- Kvaser Leaf Light v2 (www.kvaser.com)
- Kvaser CanKing (www.kvaser.com)

5.1.2 Electrical connection

Refer to [3.1 Scope of delivery, page 7](#) and [figure 4, page 11](#).

⚠ CAUTION

HIGH CURRENT ARCS - Batteries can supply very high power, and arcing can occur if the terminals are short-circuited. Always open the battery circuit before working on the motor control circuit. Wear safety glasses and use properly insulated tools to prevent shorts.

1. Connect the DEUTSCH DT06-08SA connector (Ref. 3 to Sec.3.1) of the Motor Control Cable to the DEUTSCH DT04-08PA of the AC Induction Motor N11 (Ref. 6 to Sec.3.1) (mounted on the actuator).
2. Connect the DEUTSCH DT06-08SA (Ref. 3 to Sec.3.1) connector at the other end of the Motor Control Cable to the DEUTSCH DT04-08PS-L012 (Ref. 1 to Sec.3.1) on the Quick Start e-MOVEKIT box.
3. Connect the M8 sensor cable (Ref. 4/5 to Sec.3.1) (depending on the ordered stroke of the actuator, the extension cable will be pre-installed to the limit switch) to the M8 receptacle (Ref. 1 to Sec.3.1) on the Quick Start e-MOVEKIT box. The sensor cable mounted at the front of the actuator (near the push tube) to the receptacle labelled "Limit Switch Front" on the Quick Start e-MOVEKIT box. Connect the sensor cable mounted at the back of the actuator (near the motor) to the receptacle labelled "Limit Switch Back" on the Quick Start e-MOVEKIT box.
4. Connect the AMPHENOL plug (Ref. 2 to Sec.3.1) of the Motor Power Cable (pre-installed on the motor) to the corresponding receptacle (Ref. 1 to Sec.3.1) on the Quick Start e-MOVEKIT box. Make sure the connector is firmly plugged in and the locking handle is closed.

⚠ CAUTION

Before connecting the battery power make sure the key-switch and interlock are in the OFF position and the joystick is in the middle position. Otherwise, this could lead to sparks during the connection to the battery or immediate movement of the actuator after the connection.

5. Connect the negative (black) cable (Ref. 1 to Sec.3.1) of the Quick Start e-MOVEKIT box to the negative pole of the battery.
6. Connect the positive (red) cable (Ref. 1 to Sec.3.1) of the Quick Start e-MOVEKIT box to the positive pole of the battery.

⚠ CAUTION

LEAD-ACID BATTERIES – charging or discharging generates hydrogen gas, which can build up in and around the batteries. Follow the battery manufacturer's safety recommendations. Wear safety glasses when servicing, charging and working around the battery.

LITHIUM-ION BATTERIES – Follow the battery manufacturer's "safety precautions for the Lithium-Ion battery pack". Wear safety glasses when servicing, charging, and working around the battery.

7. In case the drive command will be given via CANopen the CAN dongle (recommended Kvaser Leaf Light 2) needs to be connected to the D-SUB 9 plug on the side of the device. If the dongle is directly connected to the e-MOVEKIT a 120Ω resistor needs to be added between the CAN Hi and CAN Low.

Figure 4

Schematics Quick Start e-MOVEKIT

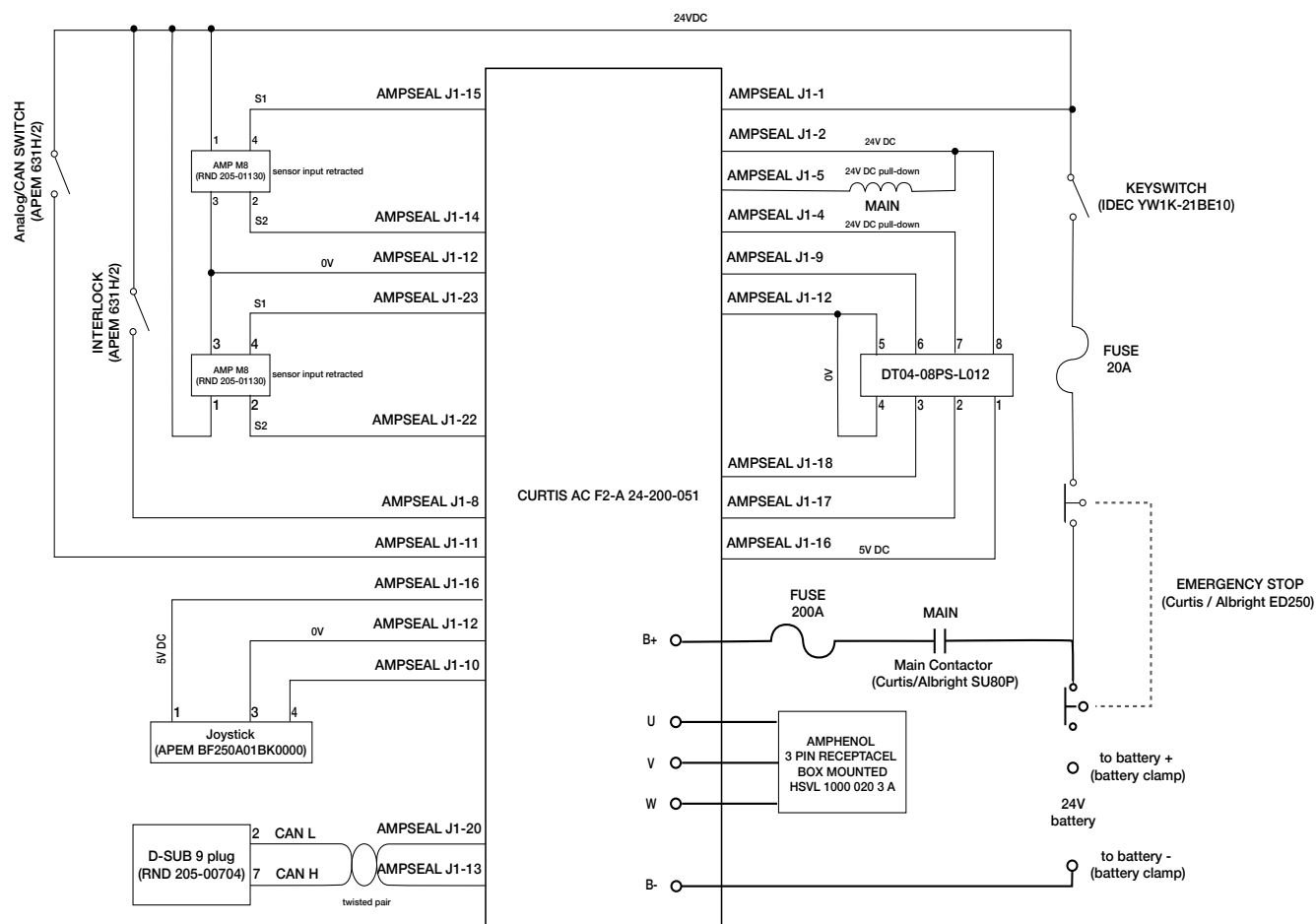
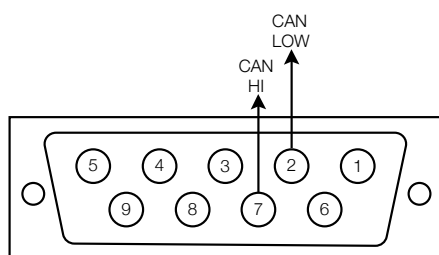


Figure 5

D-SUB 9 for CAN pinout



5.2 Installation of System Integration e-MOVEKIT

For the installation of the System Integration e-MOVEKIT, follow the instructions in the manufacturer operation manual described in [VP-10005-EN-Manual F Series Motor Controller](#).

5.2.1 Tool requirements

- Hex key size 4 and 5
- Torque wrench

5.2.2 Electrical connection

The specific electrical connections highly depend on the individual setup of the application. Follow these general steps:

1. Open the cover of the motor connection box
2. Connect the 3 motor phase terminals (U, V, W) to the motor power cables (to be ordered separately). The cables need to be secured using the delivered washers and nuts. The nuts need to be tightened to 4.6-5.6Nm. Follow [figure 6 to 9](#) for correct sequence of washers and nuts.
3. Close the cover of the motor connection box. The bolts need to be tightened to 2.5-3.5Nm.
4. Tighten the 3 cable glands on the motor connection box to max. 1.5Nm.
5. Connect the motor power cables to the corresponding terminals on the System Integration e-MOVEKIT controller (Curtis AC F2-A). Follow the instructions described inside the manufacturer operation manual ([VP-10005-EN-Manual F Series Motor Controller](#).)
6. Connect the battery power to the System Integration e-MOVEKIT controller. Follow the instructions described inside the manufacturer operation manual ([VP-10005-EN-Manual F Series Motor Controller](#)).

NOTICE

A main interlock relay needs to be put in between the positive (+) connection from the battery to the controller. Follow the wiring diagram in [figure 8](#).

Low current connections

All logic and low power connections are through a single 23-pin AMPSEAL connector (moulded in the cover) utilizing gold-plated pins. The matching AMPSEAL receptacle's wire silos come sealed by a membrane. Pierce the membrane by inserting individual terminated wires. To maintain the IP65 rating, use the proper wire gauge and insulation thickness. Seal any non-used wire positions that have their silo-diaphragm pierced with the specific AMPSEAL sealing plug. Do not mix gold and tin pin types.

Figure 6



Figure 8



Figure 7



Figure 9



The AMPSEAL Connector Components & Part Numbers

Table 2

Matching AMPSEAL 23-pin Component*	Part Number
AMPSEAL receptacle housing (the black vehicle-harness plug)	770680-1
Plug's gold-plated socket terminals (strip form p/n)	770520-3
Plug's gold plated socket terminals (loose piece p/n)	770854-3
Silo seal plug (for non-used pin positions with a pierced membrane)	770678-1)
Harness wire size (gauge)	0.5 – 1.25mm ² (20 – 16 AWG)
Wire diameter (overall) [i.e., uses wire with thin-wall insulation]	1.7 – 2.7mm
Hand Crimper for the wire-harness socket terminals	58440-1

* AMPSEAL components and tooling are available worldwide for multiple TE Connectivity electrical component distributors. Reference the TE Connectivity Document: Application Specification 114-16016

<https://www.te.com/commerce/DocumentDelivery/DDEController>
TE Connectivity website: <https://www.te.com/usa-en/products/connectors/automotive-connectors/intersection/ampseal-connectors.html>
Alternatively, the 23-pin AMPSEAL connector can be bought pre-configured (ZKA-377944).

Controller Wiring Diagram

The wiring diagram illustrates installation for the System Integration e-MOVEKIT controller and reflects the pre-configuration done by EWELLIX. The controller I/O assignment and functions can be customized to better fit the application following the manufacturers operation manual. If the Ewellix pre-configured firmware is used, follow the controller wiring diagram described in **figure 10**.

Figure 10

Schematics System Integration e-MOVEKIT

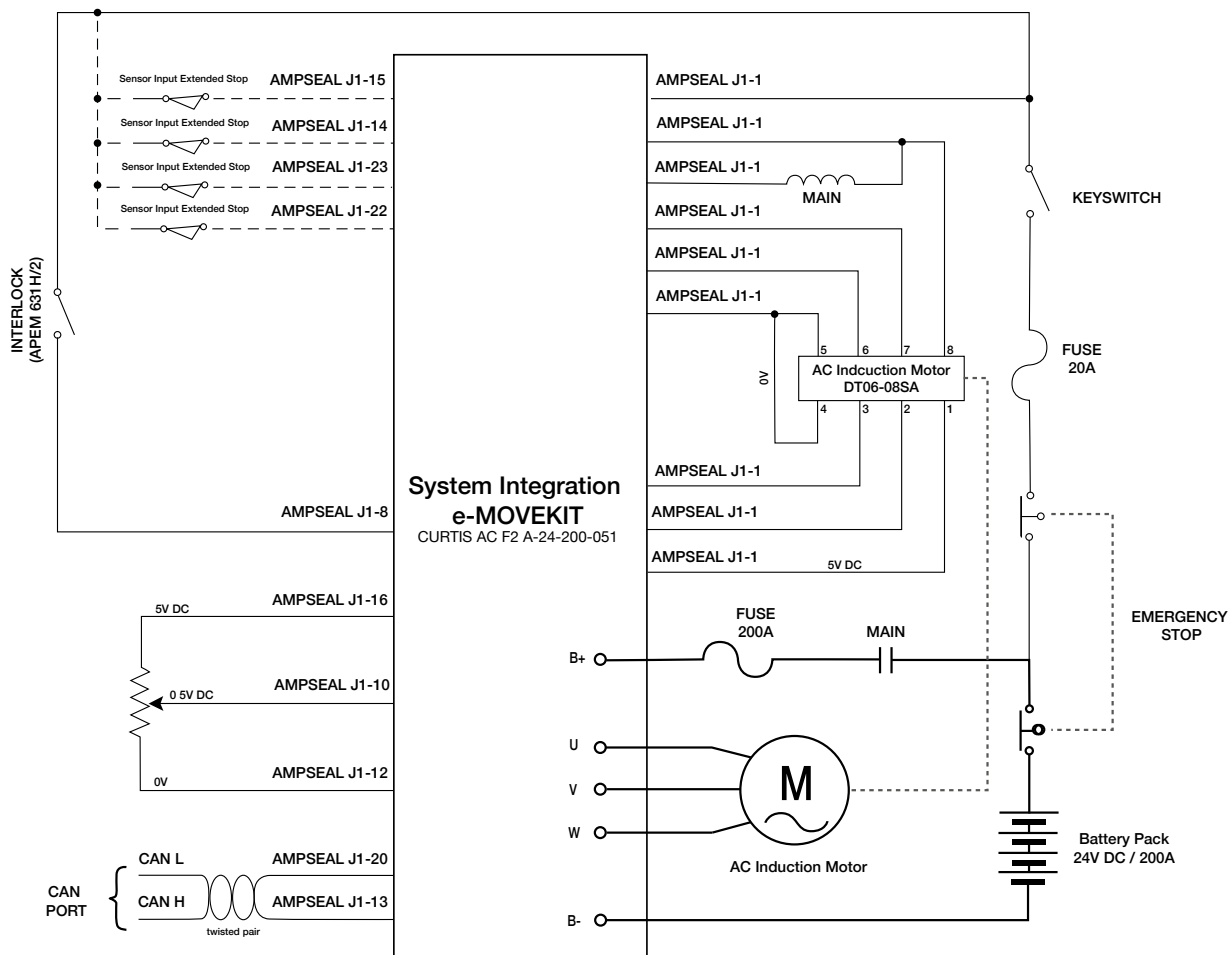
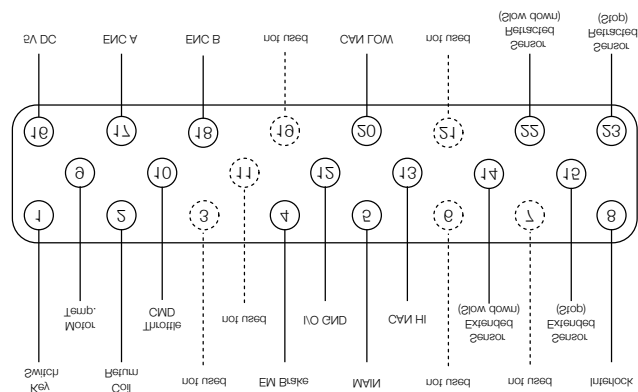


Figure 11

AMPSEAL 23pin connector wiring



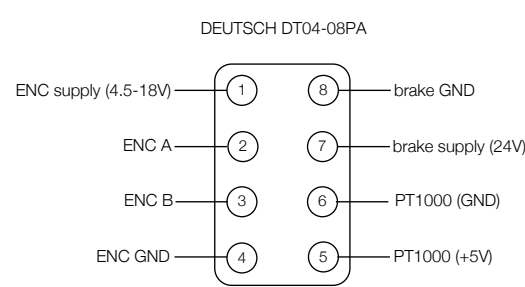
The controller can be fully customized by the operator. This is described in the manufacturer operation manual ([VP-10005-EN-Manual F Series Motor Controller](#)). In this case, the connector wiring (see **figure 10, page 13**) and pinout chart (**figure 11**) are no longer applicable and the more general description inside the manufacturer operation manual are valid.

5.3 N11 Motor Interface

The motor needs to be connected to the U V W connectors as shown in section 5.2.2. For the feedback and em-brake control the motor uses a DEUTSCH DT04-08PA interface and needs to be connected to the corresponding pins of the 23-pin AMPSEAL connector. Refer to the connector wiring diagram in section 5.2.

Figure 12

Motor connector wiring



6. Operation of e-MOVEKIT

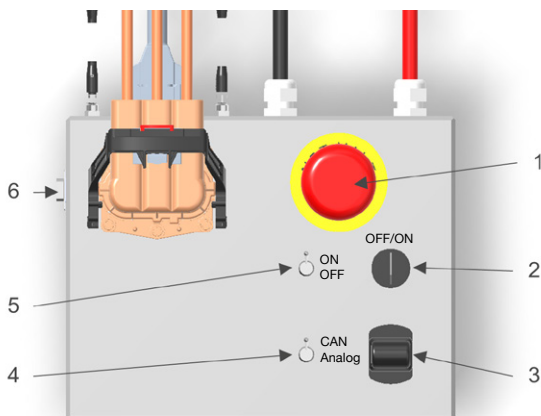
Both the Quick Start e-MOVEKIT and System Integration e-MOVEKIT can be operated via an analogue voltage throttle signal or a throttle command via CANopen. Depending on the operation mode, a different start-up sequence needs to be followed.

The Quick Start e-MOVEKIT should only be operated in lab conditions. The main purpose of the Quick Start e-MOVEKIT is to do initial prototype testing.

6.1 Operation of Quick Start e-MOVEKIT with Joystick

6.1.1 Hardware Inputs on the Box

Figure 13



1. Emergency Stop
2. Key Switch (ON/OFF)
3. Throttle Joystick
4. CAN/Analog Switch
5. Interlock Switch
6. CAN Port (D-Sub 9)

6.1.2 Operation with Joystick

CAUTION

Make sure that there is no person or object in the near vicinity of the linear actuator (EMA-100) and the application when performing the initial start-up.

0. Start-up conditions:
 - a. Emergency Stop (1) disengaged
 - b. Interlock Switch in OFF position
 - c. Key Switch in OFF position
 - d. CAN/Analog Switch in Analog position
1. Turn the Key Switch (2) to ON to enable the power supply to the controller inside the Quick Start e-MOVEKIT box. Wait for a few seconds for the controller to start up.
2. Switch the Interlock Switch (4) to ON. The Quick Start e-MOVEKIT is now operational.

NOTICE

The Interlock Switch will send a command to the controller to close the main contactor. Only when the main contactor was successfully closed, operation of the actuator will be possible.

3. The actuator movement can now be controlled by the joystick (3). Pushing the joystick towards the Emergency Stop button will result in an extending movement of the actuator. A pull away from the Emergency Stop button will result in a retracting movement of the actuator. A full deflection of the joystick in either direction will result in a movement speed equivalent to the corresponding speed defined by the type-key of the Quick Start e-MOVEKIT.

The installed limit switches come preconfigured by the factory and will slow down the movement of the actuator 40mm before reaching the lower and upper end position to 10% of the movement speed defined by the type-key. The actuator will come to a full stop when the lower and upper end position is reached.

CAUTION

The limit switches are pre-configured to the actuator. Changing their position on the linear actuator will result in a loss of their functionality. A change of position and teach-in of new positions need to be performed outside any application.

6.2 Operation of Quick Start e-MOVEKIT with CAN commands

6.2.1 Hardware Inputs on the Box

See chapter [6.1.1 Hardware Inputs on the Box, page 15](#).

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

CAN baud rate: 250Kbps

CAN Node ID: 26h

6.2.2 Operation with CAN throttle commands

Nomenclature note: A hexadecimal value written as 80000226h = 0x80000226 (all numbers below in the format 80000226h are hexadecimal values)

NOTICE

Changing the throttle mode (from Analog to CAN or vice versa) while the box is in operation will result in an error and will immediately stop the movement of the actuator.

0. Start-up conditions:
 - a. Emergency Stop (1) disengaged
 - b. Interlock Switch in OFF position
 - c. Key Switch in OFF position
 - d. CAN/Analog Switch in Analog position
1. Change program sequence: This sequence only needs to be followed when changing from Analog to CAN or vice versa.
 - a. Turn the Key Switch to ON.
 - b. Switch the CAN/Analog Switch to CAN. This will trigger an error. The error can be confirmed by cycling the main power (turn key-switch OFF and ON again).
2. Switch the Interlock Switch (4) to ON.

NOTICE

The Interlock Switch will send a command to the controller to close the main contactor. Only when the main contactor was successfully closed, operation of the actuator will be possible.

5. The controller needs to be set from the pre-operation state to the operational state. The following message will set the controller to operational.

Table 3

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

Byte 0: 1h → Go to Operational / 80h → Go to Pre-Operational

Byte 1: 26h → Node ID

NOTICE

Once the controller is set to operational it will expect a cyclical throttle command. If after setting the controller to operational no throttle signal is sent to the controller a fault condition will be triggered after 40ms.

6. Send a cyclical throttle command to the controller. Also, if there is no movement intended, a 0%-throttle command will need to be sent to the controller. The throttle signal needs to be sent in fixed intervals of 20ms. The following message will be used for the throttle command:

Table 4

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

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

Byte 0 and 1: Throttle command in percent

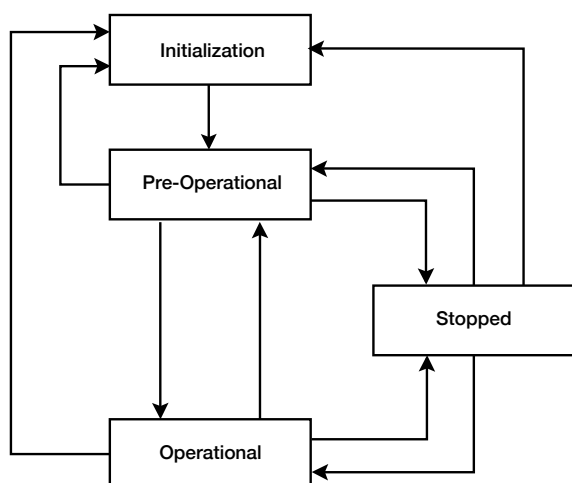
For easy reference the following table can be used. Little endian is used.

Table 5

Throttle CMD	HEX	Byte 0	Byte 1	Actuator movement
-100 %	0x8000	00h	80h	Retracting v = 100%
-80 %	0x999A	9Ah	99h	Retracting v = 80%
-60 %	0xB333	33h	B3h	Retracting v = 60%
-40 %	0xC0CD	CDh	CCh	Retracting v = 40%
-20 %	0xE667	67h	67h	Retracting v = 20%
0 %	0x0000	00h	00h	Stop / no movement
20 %	0x1999	99h	19h	Extending v = 20%
40%	0x3333	33h	33h	Extending v = 40%
60%	0x4CCD	CDh	4Ch	Extending v = 60%
80%	0x6666	66h	66h	Extending v = 80%
100%	0x7FFF	FFh	7Fh	Extending v = 100%

Figure 14

Controller State diagram



6.3 Change Max. Motor Speed of Quick Start e-MOVEKIT

The maximum linear unit speed that the controller comes preconfigured by the factory (see **EMA-100 type key, page 4**) can be changed via a CAN command. Be aware that by changing the max. motor speed changes the behaviour of the actuator and the actuator speed is bound to some physical limitations. The change in linear unit speed will be done by changing the max. motor speed in RPM. The motor speed can be calculated using the following formula:

$$n_M = \frac{V_{LU} * I_{GB}}{P_{SCR}} * 60$$

n_M Motor speed [rpm]
 v_{LU} Linear Unit Speed [mm/s]
 I_{GB} Gearbox ratio [-]
 P_{SCR} Pitch of Screw inside actuator [mm]

C A M - **C Q** - **N C** - - - **0 0 0**

Screw Type	Pitch (P_{SCR})
A (Ball Screw 32x10)	10mm
B (Ball Screw 40x10)	10mm
C (Ball Screw 40x20)	20mm

Gearbox ratio	Exact ratio (I_{GB})
B (4:1)	3.892
C (10:1)	9.827
D (25:1)	24.949

⚠ WARNING

LIMIT SWITCHES – The Linear Unit speed shall not exceed 90mm/s for the limit switches to be reliably detected by the controller. Setting the Linear Unit speed higher than 90mm/s can lead to a crash into the mechanical end-stop of the actuator (or the application) since the limit switches can no longer be detected and the actuator stopped.

⚠ CAUTION

CENTRIFUGAL BRAKE – In case the actuator comes assembled with a centrifugal brake (see actuator type key), the motor speed is limited by the centrifugal brakes initiating speed. Setting the max. motor speed higher than the centrifugal brake initiating speed will result in braking of the centrifugal brake at high linear unit speeds and will reduce the actuators performance. This is deemed as unintended use and leads to degradation of the centrifugal brakes' performance.

⚠ CAUTION

ELECTROMECHANICAL BRAKE (N11 Motor Option) – The max. allowed motor speed for the electromechanical brake mounted to the back of the N11 motor is at 3000rpm. Driving the motor at speeds higher than this will result in permanent damage and is prohibited.

NOTE

The e-MOVEKIT will prevent any max. input speed to be set higher than 3000rpm or lower than 100rpm.

6.3.1 Set new max. motor speed

1. Calculate the new max. motor speed following the formula described in 6.3.
2. Power on the Quick Start e-MOVEKIT by turning the key switch (2) ON.
3. Send the new max. motor speed via CAN:

Table 6

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

CAN identifier: *RPDO for Node ID 26h (COB ID)*
 Byte 0 and 1: *New motor max. speed RPM*

Example:

Set new max. motor speed to 1150rpm → 0x047E

Table 7

CAN identifier	DLC	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
426h	2h	7Eh	04h	-	-	-	-	-

4. The new motor speed is not yet set to the controller. The new motor speed needs to be saved by sending the following command:

Table 8

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

CAN identifier: *RPDO for Node ID 26h (COB ID)*
 Byte 0 to 3: *spells out "save" in hexadecimal*

5. Cycle power by turning the key switch (2) OFF and ON again to enable the new max. motor speed.

6.3.2 Reset to factory programmed max. motor speed

In the case the controller needs to be reset to the factory programmed max. motor speed, the following CAN command can be sent to the controller:

1. Power on the Quick Start e-MOVEKIT by turning the key switch ON.
2. Send the following command to reset to the factory max. motor speed:

Table 9

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

CAN identifier: *RPDO for Node ID 26h (COB ID)*

Byte 0 to 3: *spells out "fres" in hexadecimal*

3. Cycle power by turning the key switch OFF and ON again to enable the new max. motor speed.

6.4 Operation of System Integration e-MOVEKIT with Analog Throttle input

6.4.1 Hardware Inputs to the Controller

Follow the wiring diagram for the System Integration e-MOVEKIT in section 5.2.2 (see **figure 10, page 13**).

NOTICE

All inputs and outputs from the motor controller need to be wired up for the controller to work. The controller will automatically detect missing components and will trigger an internal error that prevents any interaction.

NOTICE

MAIN CONTACTOR – The main contactor needs to be a coil-based contactor. Any other type of main contactor will not work with the controller. Ewellix recommends the CURTIS/ALBRIGHT RU80 contactor.

6.4.2 Operation with Analog Throttle input

CAUTION

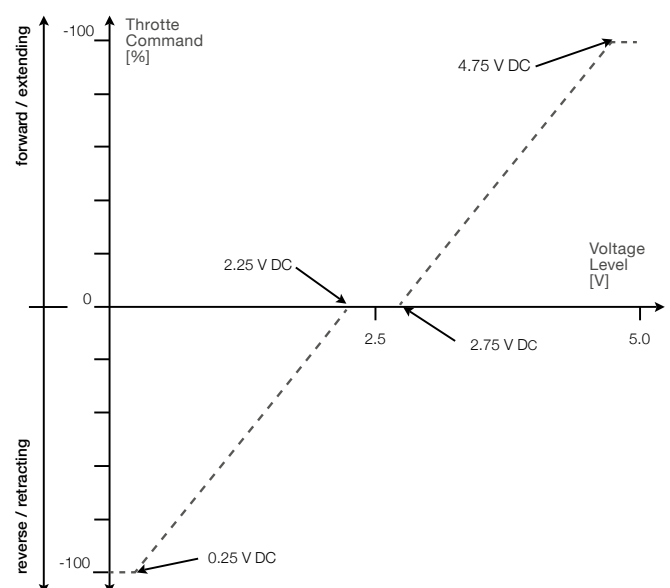
Make sure that there is no person or object in the near vicinity of the linear actuator (EMA-100) and the application when performing the initial start-up.

0. Start-up conditions:
 - a. EMERGENCY STOP disengaged
 - b. INTERLOCK SWITCH in OFF position (B+ to AMPSEAL J1-8 OPEN)
 - c. Key Switch in OFF position (B+ to AMPSEAL J1-1 OPEN)
1. Turn the KEY SWITCH to ON (B+ to AMPSEAL J1-1 CLOSED) to enable the power supply to the controller inside the System Integration e-MOVEKIT controller. Wait for a few seconds for the controller to start up (LED indicator light on controller starts flashing)
2. Switch the INTERLOCK SWITCH to ON (B+ to AMPSEAL J1-8 CLOSED). The System Integration e-MOVEKIT is now operational.
3. The actuator movement can now be controlled by applying a voltage level to AMPSEAL J1-10.

When starting the controller and switching the interlock, no drive command shall be given to the controller meaning AMPSEAL J1-10 needs to be at 2.5V DC $\pm 10\%$. Refer to **figure 15** for voltage levels on the input and resulting Throttle Command.

Figure 15

Throttle shape



Limit Switch Option

In case the System Integration e-MOVEKIT is ordered with the Limit Switch Option enabled (Other Options – Sensors = 1), the limit switches need to be connected according to the wiring diagram shown in section [5.2.2 Electrical connection, page 12](#), [figure 10](#), [page 13](#) and [table 10](#).

CAUTION

The limit switches need to be configured in a way that the actuator and the application where the actuator is built in cannot travel into the mechanical end-stops.

Table 10

Sensor Input	Function	Installation
AMPSEAL J1-15	Sensor Input Extended – Stop Will stop the actuator completely when in the fully extended position. Only movement in the reverse (retracting) direction will be possible.	The sensor shall be installed 3mm before the mechanical end-stop at the front of the actuator (fully extended) ether on the actuator or on the application.
AMPSEAL J1-14	Sensor Input Extended – Slow Down Traveling over this sensor will slow down the actuator movement in the extending direction to 10% of the commanded throttle. The retracting speed is not affected by the speed reduction.	The sensor shall be installed min. 30mm before the mechanical end-stop at the front of the actuator (fully extended) ether on the actuator or on the application.
AMPSEAL J1-23	Sensor Input Extended – Stop Will stop the actuator completely when in the fully retracted position. Only movement in the reverse (extending) direction will be possible.	The sensor shall be installed 3mm before the mechanical end-stop at the bottom of the actuator (fully retracted) ether on the actuator or on the application.
AMPSEAL J1-22	Sensor Input Extended – Slow Down Traveling over this sensor will slow down the actuator movement in the retracting direction to 10% of the commanded throttle. The extending speed is not affected by the speed reduction.	The sensor shall be installed min. 30mm before the mechanical end-stop at the bottom of the actuator (fully retracted) ether on the actuator or on the application.

WARNING

LIMIT SWITCHES – Since the linear unit's mechanical end stops are not designed to take impacts on a regular use limit switches need to be placed so that the end stops are not hit during regular operation.

If the limit switch function of the controller is not used, other means of avoiding regular impact to the mechanical end-stops need to be put in place by the OEM.

6.5 Operation of System Integration e-MOVEKIT with CAN commands

Follow the wiring diagram for the System Integration e-MOVEKIT in section 5.2.2 (see [figure 10](#), [page 13](#)).

NOTICE

All inputs and outputs from the motor controller need to be wired up for the controller to work. The controller will automatically detect missing components and will trigger an internal error that prevents any interaction.

NOTICE

MAIN CONTACTOR – The main contactor needs to be a coil-based contactor. Any other type of main contactor will not work with the controller. Ewellix recommends the CURTIS/ALBRIGHT RU80 contactor.

6.5.1 Operation with CAN throttle commands

NOTICE

Changing the throttle mode while the box is in operation will result in an error and will immediately stop the movement of the actuator.

All System Integration e-MOVEKIT motor controllers come preconfigured to run with the analogue throttle command. To switch to CAN controlled throttle commands a switch command needs to be sent to the controller. Enable power to the controller by switching on the key switch. Connect to the CAN interface.

0. Start-up conditions:

- a. Emergency Stop disengaged
- b. Interlock Switch in OFF position
- c. Key Switch in OFF position

1. Change program sequence:

This sequence only needs to be followed when changing from Analog to CAN or vis versa.

- a. Turn the Key Switch to ON.
- b. Send the following command to be the controller. This will trigger an error. The error can be confirmed by cycling the main power (turn key switch off and on again).

2. Switch the Interlock Switch (4) to ON.

Table 11

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

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

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

0 = Analog drive mode (throttle via voltage potential) is activated

NOTICE

The Interlock Switch will send a command to the controller to close the main contactor. Only when the main contactor was successfully closed, operation of the actuator will be possible.

3. The controller needs to be set from the pre-operation state to the operational state. The following message will set the controller to operational.

Table 12

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

Byte 0: 1h → Go to Operational / 80h → Go to Pre-Operational

Byte 1: 26h → Node ID

NOTICE

Once the controller is set to operational it will expect a cyclical throttle command. If after setting the controller to operational no throttle signal is sent to the controller a fault condition will be triggered after 40 ms.

4. Send a cyclical throttle command to the controller. Also, if there is no movement intended, a 0%-throttle command will need to be sent to the controller. The throttle signal needs to be sent in fixed intervals of 20ms.

Table 13

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

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

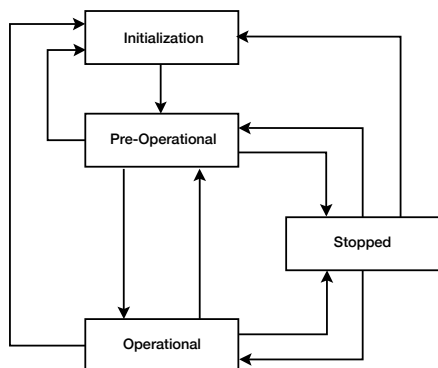
Byte 0 and 1: Throttle command in percent

Table 14

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

Figure 16

Controller State diagram



6.6 Transmit Mailbox Messages

After the controller is switched to operational (see chapter [6.4.1 Hardware Inputs to the Controller, page 19](#) or [6.5.1 Operation with CAN throttle commands, page 21](#)) it will send cyclic messages about the most critical information of the controller and motor.

General: All information will be sent as little endian.

All messages are send cyclic in 40ms intervals.

6.6.1 Transmit PDO 1

The transmit PDO 1 (TPDO1) sends the most critical information related to the motor. It sends motor rpm, motor temperature and the current RMS.

For easy reference the following table can be used.
Little endian is used.

Table 15

CAN identifier	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		-	-

Motor Speed:

Information: Rotating speed of motor shaft
Data Type: INTEGER 16
Unit: rpm (Motor revolutions per minute)

Motor Temperature:

Information: Motor temperature of integrated temperature sensor (near the stator windings).
Data Type: INTEGER 16
Unit: °C/10 (data readout needs to be divided by 10)

Current RMS:

Data Type: UNSIGNED 16
Unit: A/10 (data readout needs to be divided by 10)

6.6.2 Transmit PDO 2

The transmit PDO 2 (TPDO2) sends critical information about the controller state. It sends the battery voltage level (capacitor voltage), battery current, controller temperature and the state of the main capacitor relay (main switch).

Table 16

CAN identifier	DLC	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
2A6h	7h	Capacitor Volt		Battery Current		Controller Temperature		Main State	-

Capacitor Volt:	Information:	Battery voltage level at B+ of the controller
	Data Type:	UNSIGNED 16
	Unit:	V/100 (data readout needs to be divided by 100)
Battery Current:	Information:	Drawn current from the battery by the controller
	Data Type:	INTEGER 16
	Unit:	A/10 (data readout needs to be divided by 10)
Controller Temperature:	Information:	Temperature of the motor controller. Controller will automatically switch off if it reaches its max. Operating temperature under sustained load.
	Data Type:	INTEGER 32
	Unit:	°C/10 (data readout needs to be divided by 10)
Main State:	Information:	Status of the Main Contactor relay
	Data:	

Table 17

State	Description
0	open
1	precharge
2	weld check
3	missing check
4	closed
5	delay
6	arc check
7	open delay
8	weld check
9	fault
10	closed (when Main Enable = OFF, not configured for e-MOVEKIT)

The Main State can give you quick information about the status of the controller and can help to find potential failures why the motor is not running. For more detailed information refer to the manufacturer operation manual ([VP-10005-EN-Manual F Series Motor Controller](#)).

6.7 Manual Release on EM-Brake

WARNING

COLLAPS – Do not open the manual release or the electromagnetic brake (EM-brake) of the motor when the actuator is under load. This could lead to a collapse of the system. Opening the EM-brake while the actuator is under load should only be performed when a centrifugal brake is mounted to the gearbox. The centrifugal brake will limit the collapsing speed to a safe degree. Make sure there is no person or object near the actuator of the application.

If the manual release is opened whilst the motor is powered (Interlock-Switch (4) = ON), the controller will try to hold the motor position and starts counter acting the resulting torque from the actuator. When there is load on the actuator, this will most likely result in a small movement of the actuator in the load direction.

To allow the operation of the centrifugal brake for a manual emergency lowering of the load on the actuator, the Main Contactor needs to be opened by switching the Interlock Switch (4) =OFF (see **figure 14, page 17** or **figure 10, page 13**).

WARNING

LIMIT SWITCHES – The motor is no longer powered and can therefore not slow down or stop the actuator at the limit switch positions. The operator of the manual release needs to make sure that the mechanical end-stops are not hit.

Moving the actuator while the controller is still powered on, will trigger an unintended movement error. To confirm the error, perform a power cycle. This is not necessary if the controller was powered off during the movement.

7. Troubleshooting

Table 18

Malfunction	Possible cause	What to do
The actuator does not move	Control unit not operational	Check battery power to controller/box
		Check connections to motor
		Actuator is at an extreme position that does not allow further retraction or extension. Try movement in opposite direction.
	Interlock does not close → Fault condition is active	Try to cycle power (key switch)
		Control mode from CAN/Analogue was switched during operation. Cycle power
		Check connections from the controller to the motor (U V W and Encoder/Motor Temp. Sensor).
	Sensor signal is activated (AMPSEAL J1-15, AMPSEAL J1-23)	Check sensor signal. If the actuator is not on its end position, there should not be a sensor signal to the motor controller.
The actuator does only move slowly	Electromagnetic Brake on motor does not open	Check all connections from the controller to the motor.
	Controller is not in OPERATIONAL	Make sure the controller is put from PRE-OPERATIONAL in OPERATIONAL via the corresponding CAN command.
		Throttle-signal time out was triggered by the absence of a continuous throttle command via CAN. Put controller back into PRE-OPERATIONAL. Follow instructions in chapter 6.2 and 6.4.
	Too high loads on actuators	Remove load from system and retry with less load
	Sensor signal is activated (AMPSEAL J1-14, AMPSEAL J1-22)	Check sensor signal. If the actuator is not near its end position, there should not be a sensor signal to the motor controller.
Actuator does not stop or slow down automatically before the end positions	Sensor not configured	Repeat teach-in procedure described for the limit switches. EMA-100 operating manual
	Sensor not connected to the controller	Connect the limit switch sensors according the schematics to the controller.



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