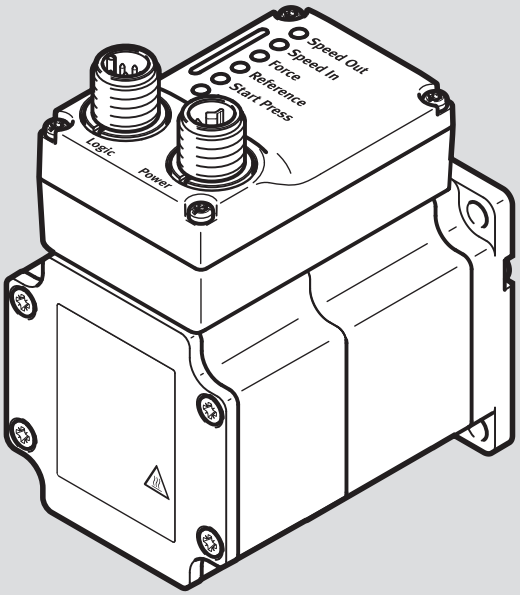
EMCS-ST
Integrated drive



FESTO

Operating instruction

CE

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[8222335]

Original instructions

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1 About this document

1.1 Applicable documents

All available documents for the product ➔ www.festo.com/sp.

Document	Product
Drive system	
Operating instruction	Mini slide unit EGSS-BS
Operating instruction	Toothed belt axis unit ELGE-TB
Operating instruction	Ball screw axis unit ELGS-BS
Operating instruction	Toothed belt axis unit ELGS-TB
Operating instruction	Electric cylinder unit EPCE-TB
Operating instruction	Electric cylinder unit EPCS-BS
Operating instruction	Rotary drive unit ERMS
Drive	
Operating instruction	Mini slide EGSC
Operating instruction	Toothed belt axis ELGR-TB
Operating instruction	Ball screw axis ELGC-BS
Operating instruction	Toothed belt axis ELGC-TB
Operating instruction	Electric cylinder EPCC
Mounting kit	
Assembly instructions	Axial and parallel kit EAMM
Accessories (IO-Link)	
Assembly instructions	Adapter NEFC-M12G8-0.3-M12G5-LK

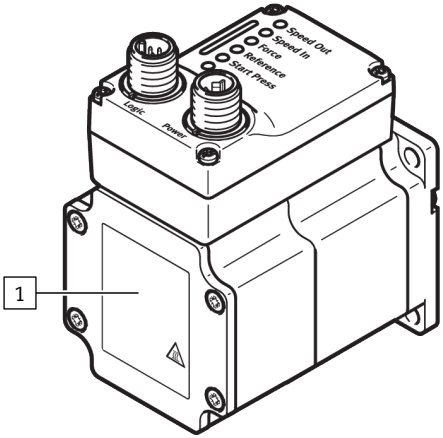
Tab. 1: Applicable documents for the product

1.2 Product version

This documentation refers to the following datasets:
- Hardware version of the integrated drive from "Rev04" or "RevD"
- Firmware version of the integrated drive from "v19.0.4.107_release"
- IO-Link device description file (IODD) from V1.2.6
- Adapter NEFC from production date 01/2022

When using a different hardware version or firmware version, check whether a corresponding version of the documentation is available ➔ www.festo.com/sp.

1.3 Product labelling



1 Product labelling (product information, approvals, warning symbol)

Fig. 1: Product labelling

Warning symbol

Warning symbol	Meaning
	Attention! Hot surface Metallic housing parts of the device can reach high temperatures during operation. In the event of a fault, internal components may become overloaded.

Tab. 2: Warning symbol

1.4 Specified standards

Version		
IEC 60204-1:2005+AMD1:2008 CSV		EN 61800-5-1:2016-08
IEC 61131-2:2013		EN 60034-1:2011-02
EN 61800-2:2016		EN 60204-1:2006+A1:2009+AC:2010

Tab. 3: Standards specified in the document

2 Safety

2.1 Safety instructions

- Only use the product if it is in perfect technical condition.
- Only use the product in its original condition without unauthorised modifications.
- Do not carry out repairs on the product. Replace defective product immediately.
- Observe the identifications on the product.
- Never remove or insert the plug connector while live.
- Operate the product only in an installed condition when all required protective measures have been taken ➔ EN 60204-1.
- Before working on the product, switch off the power supply and secure it against being switched on again.
- Store the product in a cool, dry environment protected from UV and corrosion. Keep storage times short.

2.2 Intended use

The EMCS-ST integrated drive is used as intended to drive the connected actuator technology. The integrated electronics enable control of position, speed or force/torque.

2.2.1 Application areas

The device is intended solely for use in an industrial environment.

2.3 Training of qualified personnel

Work on the product may only be carried out by qualified personnel who can evaluate the work and detect dangers.
The qualified personnel have knowledge and experience in dealing with electric drive systems.

2.4 Approvals and certifications

CE approval (conformity)
In conjunction with the CE marking on the product, the EC directives and standards listed below in the declaration of conformity apply ➔ www.festo.com/sp.

KC certification
KC number: RR-FTO-KC-2018-1082

RCM certification
The product fulfils the EMC requirements for Australia and New Zealand with the RCM certification mark on the product.

3 Additional information

- Contact the regional Festo contact if you have technical problems ➔ www.festo.com.
- Accessories and spare parts ➔ www.festo.com/catalogue.

4 Product overview

4.1 Function

The following components are integrated in the EMCS-ST integrated drive for all product variants:
- Stepper motor for driving the connected actuator technology
- Encoder for detecting the current position
- Electronics for DC link voltage conditioning
- Power stage for actuation of the motor
- Temperature sensors for monitoring the power stage temperature

The integrated drive EMCS-ST has separate connections for the supply of logic and load voltage. The load voltage (24 V DC) for all product variants must be supplied directly by a PELV fixed power supply. The logic voltage (24 V DC) is supplied as follows:
- DIO operation (digital I/O): by a PELV fixed power supply
- IO-Link operation: by the IO-Link Master

All product variants can be controlled by digital inputs/outputs (DIO) or IO-Link (LK) at the [Logic] connection.

4.2 System overview

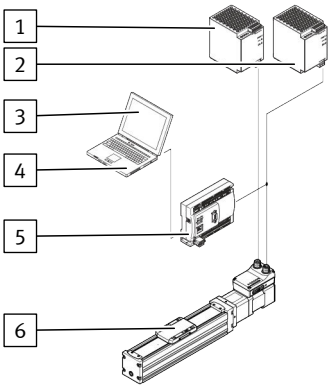


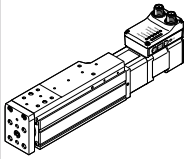
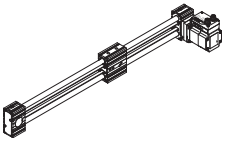
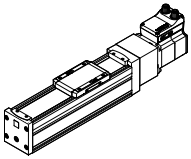
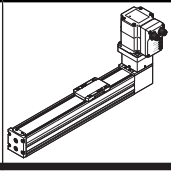
Fig. 2: System overview (with ELGS-BS as example)

1 PELV fixed power supply for load voltage supply
2 PELV fixed power supply for logic power supply
3 Application software
4 PC or laptop
5 Controller or IO-Link master
6 Ball screw axis unit ELGS-BS

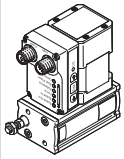
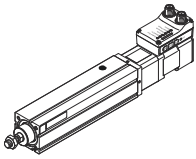
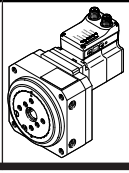
Items 1 ... 5 are not included in the scope of delivery.

Overview of drive systems with integrated drive EMCS-ST

The integrated drive EMCS-ST is included in the following drive systems.

Mini slide unit	**Toothed belt axis unit**	**Ball screw axis unit**	**Toothed belt axis unit**
EGSS-BS	ELGE-TB	ELGS-BS	ELGS-TB
			

Tab. 4: Overview of mini slide unit and axis units with integrated drive EMCS-ST

Electric cylinder unit	**Electric cylinder unit**	**Rotary drive unit**
EPCE-TB	EPCS-BS	ERMS
		

Tab. 5: Overview of the electric cylinder units and rotary drive unit with integrated drive EMCS-ST

4.3 Product design

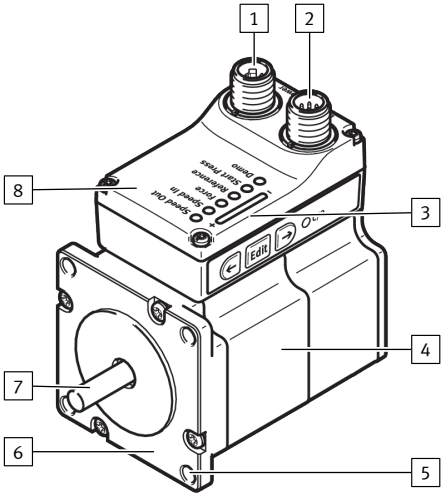


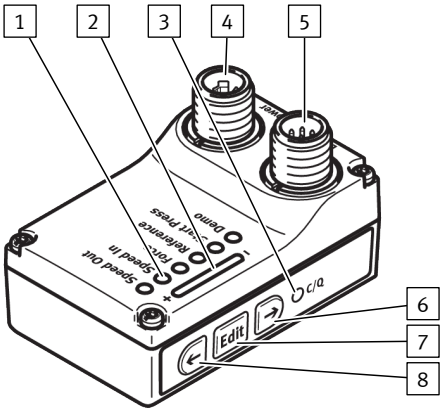
Fig. 3: Product design EMCS-ST (example EMCS-ST-57 -...)

1 [Power] connection: load voltage supply
2 [Logic] connection: logic power supply and digital I/Os (DIO) or IO-Link (LK)
3 Display and control elements (HMI)
4 Stepper motor
5 Mounting holes
6 Motor flange
7 Motor shaft
8 Controller housing

5 Display and control elements (HMI)

5.1 Overview

The display and control elements (HMI) offer comprehensive options for parameterisation and control of the integrated drive EMCS-ST.
Various LED displays are available on the controller housing for displaying parameter information, motion status and menu selection.
Three pushbutton actuators are used to navigate through the menu or to control motions, e.g. to perform a homing run.



1 LED display menu (Speed Out, ..., Demo)
2 LED parameter display
3 LED C/Q
4 [Power] connection: load voltage
5 [Logic] connection: logic voltage and digital inputs/outputs or IO-Link
6 Pushbutton actuator [right arrow]
7 Pushbutton actuator [Edit]
8 Pushbutton actuator [left arrow]

Fig. 4: Electrical connections, display and operating components (HMI)

5.2 Master control

The master control of the display and operating components (HMI) is controlled via the "Unlock/lock pushbutton actuators" function. When the pushbutton actuators are unlocked, the "Display and operating components (HMI)" interface automatically receives master control via the integrated drive EMCS-ST. The master control returns to the active control interface digital inputs and outputs (DIO) or IO-Link (LK) when the pushbutton lock is active again.

The function of the three pushbutton actuators ←/Edit/→ can be blocked or enabled via the IO-Link parameter 0x000C.4 ‘Device access lock’.

Unlocking pushbutton actuators
Press and hold pushbutton actuator Edit for at least 3 seconds to disable the pushbutton actuator lock.

Locking pushbuttons
Press and hold pushbutton actuator Edit for at least 3 seconds or do not press any pushbutton actuators ←/Edit/→ for 15 seconds to activate the pushbutton lock.

5.3 HMI menu

The display and operating components (HMI) can be used to perform the following functions in the HMI menu:

- Unlock pushbutton actuators (Unlock HMI), press and hold for 3 s Edit — an active positioning task in DIO or IO-Link mode is stopped
  (Condition for IO-Link operation: IO-Link parameter 0x000C.4 = false)
- Select menu function with pushbutton actuators ← → press ‘Selecting menu’, Edit
- Parameterise Speed Out, Speed In and Force setpoint values
  (Set value: 10, 20,..., 100% of the maximum value ➔ drive system instruction manual, technical data) and press save (‘Save’), Edit
- Parameterise position of reference end position "Ref" ‘Set Ref’ and run homing with detection of the Mov_{Ref} end position ($Start_{Ref}$: Pos_{Act} ➔ Lim_{In} ➔ Lim_{Out}), press Edit
- Run Start Press movement (Start/Stop) and save Start Press Position $Pos_{Start\ Press}$ ‘Save’, press Edit
- Execute demo run (Start/Stop)
- Lock pushbutton actuators ‘Lock HMI’, press and hold for 3 s Edit or no input for 15 s
- To acknowledge an error, press and hold Edit for 3 s (from FW version v19.0.4.107_release)
- Reset to factory settings, press ←/Edit/→ simultaneously for 10 s and then execute a Power OFF/ON on the logic power supply 24 V DC [pin 1].

HMI menu structure

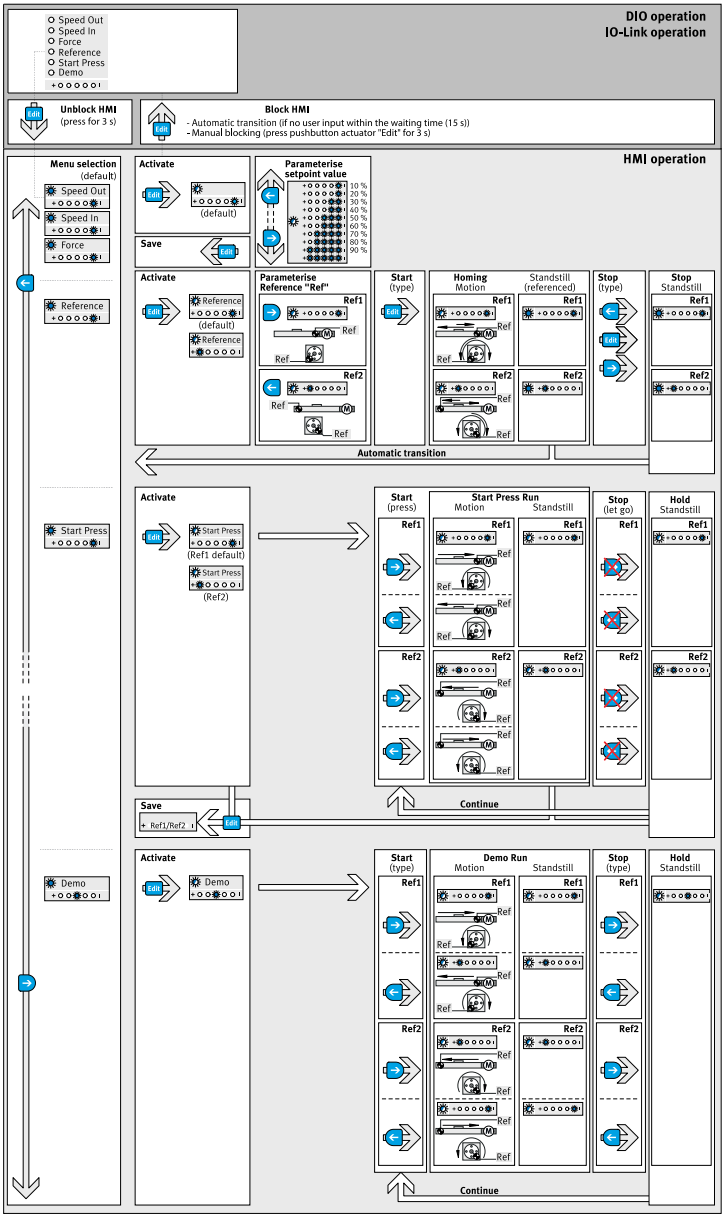


Fig. 5: HMI menu structure

The HMI menu structure shows the states of the LED displays for the parameters and the menu selection, the state transitions between the menu sequences (pushbutton actuator navigation) and the motions of the drive systems when performing motion tasks.

6 Transport

- Store and transport the product in its original packaging.
- Store the product in areas where it is not exposed to oils, greases and degreasing vapours.

7 Assembly

7.1 Safety

⚠ WARNING

Risk of injury due to unexpected movement of components.

The drive can move freely in the voltage-free state. This can cause unexpected movements of the connected mechanics and crush parts of the body.

- Bring moving parts of the mechanical system into a safe position.

7.2 Mounting clearances

Drive systems with integrated drive EMCS-ST can be connected in series. When connecting drive systems in series, a minimum distance must be maintained to allow the heat generated during operation to dissipate by allowing sufficient air flow.

- Maintain a minimum lateral distance of at least 20 mm between the integrated drive EMCS-ST and adjacent components.
- Take into account the clearance required for connecting the cables (the cables at the [Logic] and [Power] connections can be routed upwards (straight) or laterally (angled)).
- Do not install any temperature-sensitive components near the integrated drive EMCS-ST. The integrated drive EMCS-ST can become very hot during operation.

Assembly instructions

- Mount the drive system flat on a sufficiently stable mounting surface.
- Maintain minimum clearances and installation space to guarantee sufficient air flow. The ambient air must be able to flow unhindered around the integrated drive EMCS-ST.

7.3 Installation

- Mount the product ➔ Instruction manual, mounting the corresponding drive.

8 Installation

8.1 Safety

⚠ WARNING

Risk of injury due to electric shock.

- For the electrical power supply with extra-low voltages, use only SELV circuits that ensure a reliable separation from the mains network.
- Observe IEC 60204-1/EN 60204-1.

8.2 Information on EMC-compliant installation

The integrated drive EMCS-ST fulfils the following tasks:

– Guaranteed immunity to interference

– Limits the conducted emissions

If mounted correctly and if all connecting cables are wired correctly, the device meets the specifications of the product standard IEC 61800-3.

The category fulfilled by the device depends on the operating mode and the cable length.

Order code	Category	Pulse-width modulation frequency [kHz]	Max. permissible line length [m]
EMCS-ST-...	C3) (Industrial environment)	20	15, DIO operation 20, IO-Link operation

Tab. 6: Category according to the pulse-width modulation frequency and the cable length

Laying cables

Follow the general guidelines for EMC-compliant installation, e.g.:

– Do not lay signal cables parallel to power cables.

– Comply with required minimum distances between signal cables and power cables dependent on the installation conditions. Signal cables must be laid as far away from power cables as possible.

– Do not cross signal cables with power cables or cross them at a 90° angle.

8.3 Functional earth (FE) and protective earth (PE) connection

When connecting the functional earth (FE) and the protective earth (PE), follow the specifications of EN 60204-1.

Functional earth (FE)

– Connect the functional earth (FE) to the following points before commissioning:
  – EMCS-ST: FE connection, pin 4 [Power]
  – PELV fixed power supply: FE connection of the PELV fixed power supply (the PELV fixed power supply must be connected to the protective earthing (PE))

Protective earthing (PE)

– Connect the protective earthing (PE) to one of the following locations before commissioning:
  – Drive system: profile slot or threaded hole
  – Mounting surface or mounting frame: depending on application

8.4 Connection variants

Damage to the device due to non-approved potentials at the pins

- Power connection:
  - Do not connect pin 3
- GND and L– connections:
  - Apply the Power, GND [Pin 2] and Logic, GND/L– [Pin 4/8] connections to one potential. For example, ensure the same potential by using a common fixed power supply or an electrical connection of the two 0 V DC GND potentials.

When using hardware version "Rev02" or "RevB" or older, check additional precautionary measures to avoid damage to the device due to impermissible potentials on the pins in the corresponding version of the documentation ➔ www.festo.com/sp

The connection of the integrated drive EMCS-ST depends on the "DIO operation" (digital inputs/outputs) or "IO-Link operation" actuation mode and the connecting cables (with or without adapter).

1. Connect the power cable to the [Power] connection of the integrated drive EMCS-ST and to a PELV fixed power supply.
2. Connect the logic cable to the [Logic] connection of the integrated drive EMCS-ST and to a controller or to a IO-Link master.

8.4.1 Wiring diagram: DIO operation (digital I/Os)

In NPN mode defined levels must be applied to the DI1/DI2 digital inputs of the EMCS, e.g. by controller outputs with pull-up resistors (4.3 kΩ recommended).

The diagram shows the electrical connections of the integrated drive EMCS-ST to the load voltage supply and logic power supply and to the higher-level control (Controller) in DIO mode.

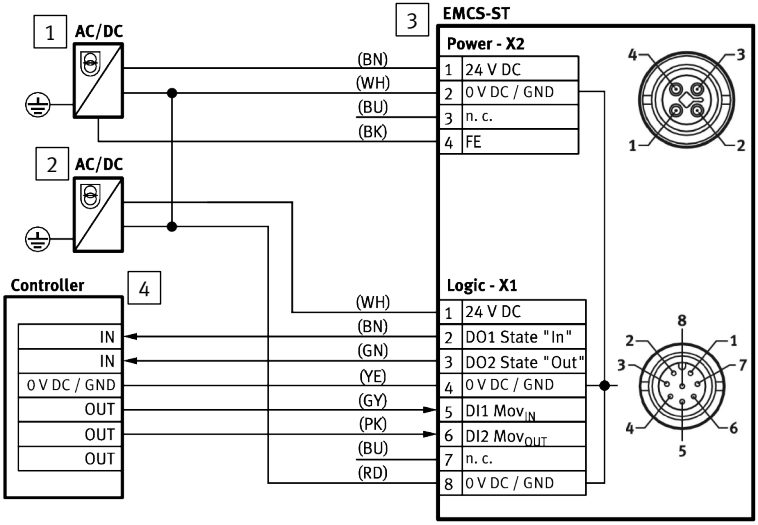


Fig. 6: Wiring diagram: DIO operation, digital I/O

1 PELV fixed power supply for the load voltage supply

2 PELV fixed power supply for the logic power supply

3 Integrated drive EMCS-ST

4 Higher-order controller with digital I/O

Status and control signals

The following table shows the status and control signals and the electrical levels of the digital inputs and outputs as a function of the "PNP/NPN" version of the integrated drive.

Status signals and control signal	Electrical levels	
	PNP, positive logic	NPN, negative logic
0	Low level (0 V)	High level (24 V)
1	High level (24 V)	Low level (0 V)

Tab. 7: Overview of status and control signals as a function of electrical levels

8.4.2 Wiring diagram: IO-Link operation

The diagram shows the electrical connections of the integrated EMCS-ST drive to the load voltage supply and to the higher-level IO-Link master in IO-Link operation.

Current consumption of IO-Link power supply [Logic]

An input current at pin 1 (L+) of 100 ... 150 mA is required for operation.

Connecting IO-Link directly to the master

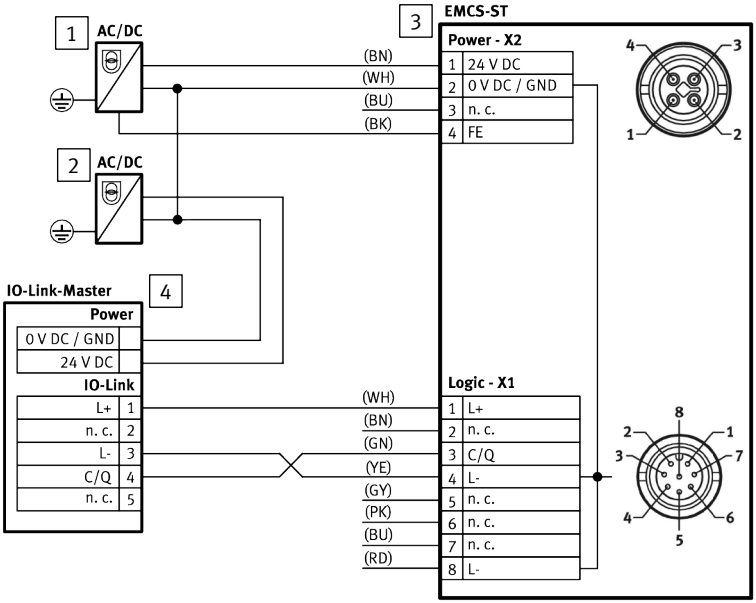


Fig. 7: Wiring diagram: IO-Link operation

1 PELV fixed power supply for the load voltage supply

2 PELV fixed power supply for the logic power supply

3 Integrated drive EMCS-ST

4 IO-Link master with IO-Link interface, port class A

Connecting IO-Link to the master via the NEFC adapter

Adapter NEFC up to production date 2021

NEFC adapters up to production date 2021 can only be used for IO-Link masters with port class A.

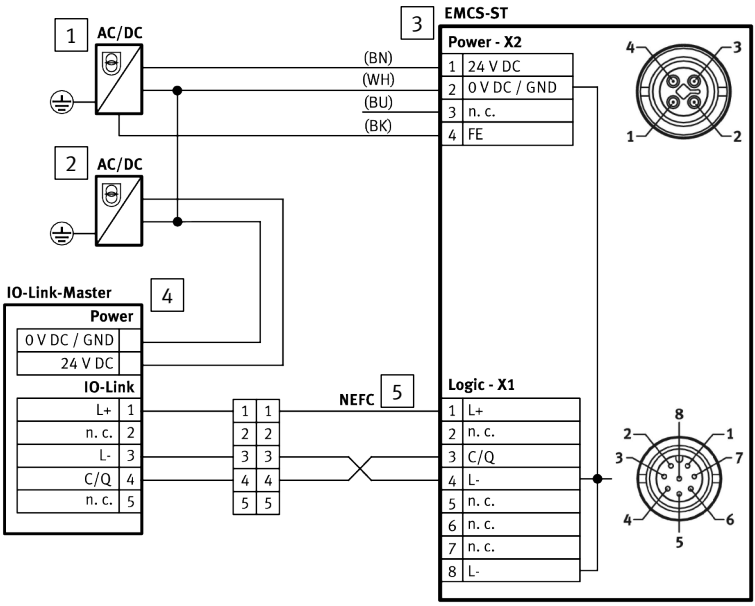


Fig. 8: Wiring diagram: IO-Link operation via adapter NEFC

1 PELV fixed power supply for the load voltage supply

2 PELV fixed power supply for the logic power supply

3 Integrated drive EMCS-ST

4 IO-Link master with IO-Link interface

5 Adapter NEFC

Core colours of Festo cables:
BK = black, BN = brown, BU = blue, GN = green, GY = grey, PK = pink, WH = white, YE = yellow

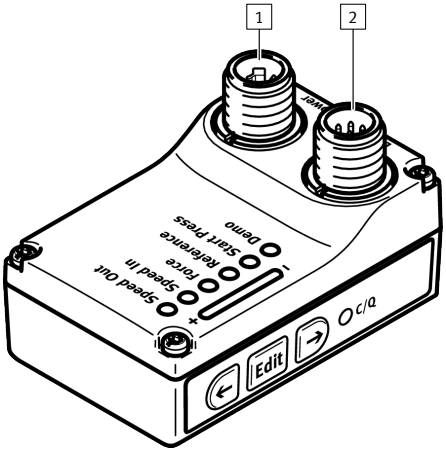
8.5 Electrical interfaces

All product variants of the integrated drive EMCS-ST support the following electrical interfaces depending on the higher-level control interface:

Electrical interface	Connection	Control interface	
		Digital inputs/outputs	IO-Link Master
Digital inputs/outputs (DIO)	[Logic]	yes	–
IO-Link (LK)		–	yes
Logic voltage supply		yes	yes
Load voltage supply	[Power]	yes	yes

Tab. 8: Overview of electrical interfaces

The electrical interfaces are located on the top of the controller housing.



1 [Power] connection: load voltage supply

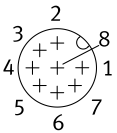
2 [Logic] connection: logic power supply and digital I/O or IO-Link

Fig. 9: Overview of electrical interfaces

8.5.1 [Logic] connection: digital I/O (DIO), logic power supply

The [Logic] connection is used to exchange digital input/output signals (PNP or NPN logic) with the higher-order controller and to supply the logic part of the electronics with electrical power.

In NPN operation defined levels must be present at the digital inputs DI1 / DI2 of the EMCS, e.g. by controller outputs with pull-up resistors.

[Logic][1]	Pin	Function	Description	Switching logic
	1	24 V DC	Logic voltage supply	–
	2	State "In"	Digital output 1 (DO1), status signal for “Lim_{In} (Ref)” end position	PNP/NPN
	3	State "Out"	Digital output 2 (DO2), status signal for "Lim_{Out}" end position or "Force" setpoint value	PNP/NPN
	4	0 V DC/GND	Reference potential for logic power supply [2]	–
	5	Mov_{In}	Digital input 1 (DI1), control signal for "Mov_{In}" positioning task	PNP/NPN
	6	Mov_{Out}	Digital input 2 (DI2), control signal for "Mov_{Out}" positioning task	PNP/NPN
	7	n. c.	reserved, do not connect	–
	8	0 V DC/GND	Reference potential for logic power supply [2]	–

1) M12x1 plug, A-coded, 8-pin

2) Pins 4 and 8 are internally connected.

Tab. 9: [Logic] connection: digital I/O (DIO), logic power supply

8.5.2 [Logic] connection: IO-Link (LK), port class A

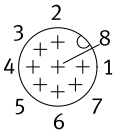
IO-Link data are exchanged with the IO-Link master via the [Logic] connection and the logic part of the device is supplied with electrical voltage.

An adapter is available as an accessory for convenient connection to the IO-Link master➔ www.festo.com/catalogue.

Adapter NEFC

Depending on the production date, the NEFC adapter can be used as follows:

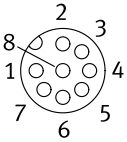
- Until 12/2021: for IO-Link masters, port class A.
- From 01/2022: for IO-Link masters, port class A and B.

[Logic][1)]	Pin	Function	Description
	1	L+	IO-Link power supply 24 V DC
	2	n. c.	reserved, do not connect
	3	C/Q	Communication to the IO-Link Master
	4	L–	Reference potential IO-Link power supply 0 V DC [2)]
	5	n. c.	reserved, do not connect
	6	n. c.	reserved, do not connect
	7	n. c.	reserved, do not connect
	8	L–	Reference potential IO-Link power supply 0 V DC [2)]

1) M12x1 plug, A-coded, 8-pin
2) Pin 4, 8 [Logic] and Pin 2 [Power] are connected internally.

Tab. 10: [Logic] connection: IO-Link (LK)

Requirements for plug and cable

Requirements for mating plugs		
	Design	M12x1 socket, A-coded
	Number of pins	8
	Nominal current	2 A
	Rated voltage	30 V DC
	Degree of protection	IP65
	Shielding	no

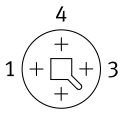
Tab. 11: Requirements for mating plugs

Requirements for the connecting cable	
Number of insulated wires and shielding	8 insulated wires, unshielded
Min. cable cross section	0.25 mm²
Max. cable length	15 m (DIO mode) 20 m (IO-Link operation)

Tab. 12: Requirements for the connecting cable (single device)

8.5.3 [Power] connection: load voltage supply

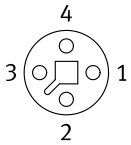
The power unit of the electronics is supplied with voltage via the [Power] connection.

[Power][1)]	Pin	Function	Description
	1	24 V DC	Load voltage supply
	2	0 V DC/GND	Reference potential load voltage supply [2)]
	3	n. c.	reserved, do not connect
	4	FE	Functional earth (FE)

1) M12x1 plug, T-coded, 4-pin
2) Pin 4, 8 [Logic] and Pin 2 [Power] are connected internally.

Tab. 13: [Power] connection: load voltage supply

Requirements for plug and cable

Requirements for mating plugs		
	Design	Socket M12x1, T-coded
	Number of pins	4
	Nominal current	12 A
	Rated voltage	63 V DC
	Shielding	no

Tab. 14: Requirements for mating plugs

Requirements for the connecting cable	
Number of insulated wires and shielding	4 insulated wires, unshielded
Min. cable cross section	1.5 mm²
Max. cable length	15 m

Tab. 15: Requirements for the connecting cable (single device)

9 Commissioning

Preparation for initial commissioning or replacement of components:

– Update device data via IO-Link interface

- Updating firmware ➔ 10.2.1 Firmware
- Updating parameter set ➔ 10.2.2 Parameter set
- Data backup (Data Storage) ➔ 10.2.3.1 Perform data backup ‘Data Storage’ (from firmware version v19.0.4.107_release)

9.1 Commissioning "DIO operation (digital I/O)"

⚠ WARNING

Risk of injury due to unexpected movement of components.
When starting the homing run, the drive is disconnected from the power supply for a short time. This can cause unexpected movements of the connected mechanics and crush parts of the body.
- Bring moving parts of the connected mechanical system into a safe position.

Preparation:

1. Check mounting of the drive system.
2. Check wiring of the power supplies and the "DI/DO" digital inputs and outputs at the [Power] and [Logic] connections.

ⓘ

When using hardware version "Rev02" or "RevB" or older, check additional precautionary measures to avoid damage to the device due to impermissible potentials on the pins in the corresponding version of the documentation ➔ www.festo.com/sp

Procedure:

1. Switch on load voltage.
2. Switch on logic voltage via IO-Link master. A switch-on delay of ≥50 ms is recommended.
   ↳ If the logic voltage is switched on before the load voltage, the EMCS-ST starts with an error that must be acknowledged.
3. Wait for initialisation until C/Q LED is yellow (≈ 7 s).
4. Select the reference end position "Ref" from the HMI interface in the ‘Reference’ menu and start the homing movement with end position detection (only required if the reference end position "Ref" is different from the factory setting or if the useful range has been changed). The drive system is referenced after a successful homing.

   ⓘ

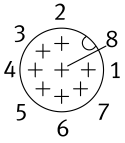
   Homing sets the Start Press "$Pos_{Start\ Press}$" position equal to the calculated useful range.
5. Parameterisation of operating modes via HMI interface:
   Basic parameters for point-to-point operation with and without press function or manual operation (demo)
   - Speed ‘Speed Out’
   - Speed ‘Speed In’

   additional parameters for point-to-point operation with press function
   - Force ‘Force’
   - Start Press "$Pos_{Start\ Press}$" position (reference point end position "Ref")

The EMCS-ST is then ready for operation and the application can be controlled via the "DI/DO" digital inputs and outputs ➔ 10.3 Operating modes

Controlling point-to-point operation via digital inputs

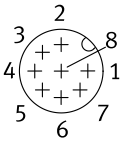
The following table shows the combinations of the "Mov_{In}" and "Mov_{Out}" control signals for controlling the drive in point-to-point operation via the digital inputs DI1 and DI2 at the [Logic] connection.

[Logic]	Pin 5, DI1	Pin 6, DI2	Description
	"Mov_{In}"	"Mov_{Out}"	
	0	0	Control signals for stopping the motion task – The power stage remains active – The drive decelerates to standstill – The drive remains at position-controlled standstill
	0	1	Control signals for executing the "Mov_{Out}" motion task – The drive moves towards the "Lim_{Out}" end position under position control – In point-to-point operation with press function the drive travels from the “Start Press” position to the “Lim_{Out}” end position under force control – After a restart, the "Ref" reference end position is re-initialised first
	1	0	Control signals for executing the "Mov_{In}" motion task – The drive moves towards the "Lim_{In}(Ref)" end position under position control – After a restart, the "Ref" reference end position is re-initialised first
	1	1	Control signals for switching off the power stage – The power stage is switched off after the activation time = 3 s – The drive coasts to a standstill – At standstill, the drive remains stopped unregulated Control signals for acknowledging errors (from FW version v19.0.4.107_release) – The error is automatically deleted from the diagnostic memory on acknowledgement.

Tab. 16: Control signal combinations at digital inputs DI1 and DI2

Monitoring point-to-point operation via digital outputs

The following table shows the combinations of the "State $_{In}$" and "State $_{Out}$ status signals for monitoring the drive in point-to-point operation via the digital outputs DO1 and DO2 at the [Logic] connection.

[Logic]	Pin 2, DO1	Pin 3, DO2	Description
	"State $_{In}$"	"State $_{Out}$"	
	0	0	Status signals for – neither of the two "Lim$_{In}$(Ref)" or "Lim$_{Out}$" end positions is reached
	0	1	Status signals for – "Lim$_{Out}$" end positions reached – Parameterised force "Force" reached in force-controlled range of point-to-point operation with press function
	1	0	Status signals for – "Lim$_{In}$(Ref)" end positions reached
	1	1	Status signals for – critical error ➔ 12.2.2 Diagnostic messages and fault clearance.

Tab. 17: Status signal combinations at digital outputs DO1 and DO2

9.2 Commissioning "IO-Link operation"

⚠ WARNING

Risk of injury due to unexpected movement of components.

When starting the homing run, the drive is disconnected from the power supply for a short time. This can cause unexpected movements of the connected mechanics and crush parts of the body.

- Bring moving parts of the connected mechanical system into a safe position.

Preparing commissioning

1. Check mounting of the drive system.
2. Check the wiring of the power supplies and the IO-Link "C/Q" interface at the [Power] and [Logic] connections.
3. Download application software, IODD device description file, IOLFW firmware file and IOLFW parameter set ➔ www.festo.com/sp.
4. Install the application software.
5. Open IODD file in the application software.

ⓘ

When using hardware version "Rev02" or "RevB" or older, check additional precautionary measures to avoid damage to the device due to impermissible potentials on the pins in the corresponding version of the documentation ➔ www.festo.com/sp

Commissioning procedure

1. Switch on load voltage.
2. Switch on logic voltage via IO-Link master. A switch-on delay of ≥50 ms is recommended.
   ↳ If the logic voltage is switched on before the load voltage, the EMCS-ST starts with an error that must be acknowledged.
3. Wait for initialisation until C/Q LED is yellow (≈ 7 s).
4. Select the reference end position "Ref" from the IO-Link device data (0x0103.0 'Reference') and start the homing movement with end position detection (0x0104.0, 'Execute "Reference" Movement')(only required if the "reference end position Ref" is different from the factory setting or if the useful range has been changed). The drive system is referenced after a successful homing
   ➔ 15.2.2 Device data.

   ⓘ

   Homing sets the "Pos_{Imp}" intermediate position and the "$Pos_{Start\ Press}$" start press position equal to the determined useful range.

   ---

5. Parameterisation of operating modes via IO-Link interface:
   Basic parameters for point-to-point operation with and without press function or manual operation (demo):
   - 0x0100.0 velocity 'Speed In'
   - 0x0101.0 velocity 'Speed Out'
   - 0x0106.0, end position "Out" "Lim_{Out}" (reference point reference end position "Ref")
   - 0x0108.0, intermediate position "Pos_{Imp}" (reference end position "Ref")(from firmware version v19.0.4.107_release)

   Additional parameters for point-to-point operation with press function.
   - 0x0102.0 force 'Force'
   - 0x0105.0 Start Press "$Pos_{Start\ Press}$" position (reference point end position "Ref")

   ↳ Then the EMCS-ST is ready for operation and the application can be controlled via the IO-Link interface "process data 0x0029.1, 0x0029.2 and 0x0029.5" or "system parameter 0x0002"
   ➔ 15.2.5 Control point-to-point operation via IO-Link.

10 Drive system

10.1 Dimensions and units

10.1.1 Basic units and user units

The following quantities and units can be read or written via the IO-Link parameters.

Force control 'Force'

Force is controlled and evaluated by closed-loop control of the motor current. A torque level or a linear force can be determined from the level of current measured depending on the mechanism of the drive. The target is set as a percentage of the rated motor current and may deviate from the actual force on the drive unit. If force levels are set low, the influence of friction in the system on the running behaviour and the actual force on the drive unit must also be taken into account.

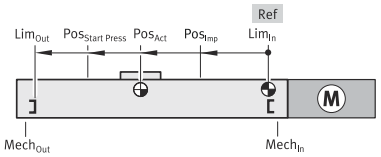
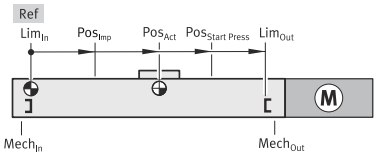
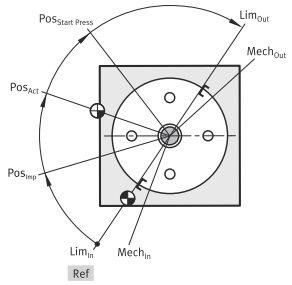
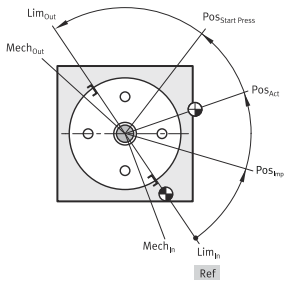
Size	**Unit**	
	Linear drive system	Rotary drive system
Length	[mm]/[km]	–
Angle	–	[°] as position [number of revolutions] as mileage
Velocity	[mm/s]	[rpm]
Force	[N]	–
Torque[)]	–	[Nm]
Temperature	[°C]	[°C]

Tab. 18: Sizes and units

10.1.2 Dimension reference system

The correct positioning of the drive requires a defined dimension reference system. To define the dimension reference system, the reference end position "Ref" must be selected during commissioning.

Overview of dimension reference systems

Parameterisation of the reference end positions "Ref"	
Factory setting	
– HMI: 'Reference' menu – IO-Link: 0x0103.0 'Reference' = false	– HMI: 'Reference' menu – IO-Link: 0x0103.0 'Reference' = true
Dimension reference system for linear drive systems	
Reference end position "Ref" facing motor	Reference end position "Ref" facing away from motor
	
Dimension reference system for rotary drive systems (ERMS: view of the rotating plate)	
Left reference end position "Ref"	Right reference end position "Ref"
	

Ref	Reference end position "Ref" (reference point for Lim_{Out}, Pos_{Act}, Pos_{Imp} and $Pos_{Start\ Press}$)
Lim_{In}	"In" end position (= reference end position "Ref")
Lim_{Out}	End position "Out"
Pos_{Act}	current position
Pos_{Imp}	Intermediate position (Intermediate Position) (IO-Link only)
$Pos_{Start\ Press}$	"Start Press" position

Overview of dimension reference systems	
$Mech_{In}$	mechanical stop "In"
$Mech_{Out}$	mechanical stop "Out"

Tab. 19: Dimension reference system for linear and rotary drive systems

10.2 Controller

10.2.1 Firmware

The integrated drive supports the use of different firmware packages, which differ in functionality and behaviour. If required, the integrated drive can be updated to the latest firmware package using application software or unified in a system with multiple Simplified Motion Series systems.
The firmware update process varies depending on the firmware version. The current firmware version of the device can be read via the parameter 0x0017.0 ‘Firmware Revision’. All usable firmware packages and the necessary device description files are available for download in the Support Portal
➔ www.festo.com/sp.

The firmware can only be updated via IO-Link.

Operation		**Firmware update (file Handling)**	**Functions**
Firmware version	IODD version	IODD version	
v16.0.15.72_release ... v16.0.18.92_release	V1.0.21	V1.2.6	Basic functions: – HMI, DIO and IO-Link operation – Simple point-to-point operation – Point-to-point operation with press function
v19.0.4.107_release ... and newer	V1.2.6		Function extension: – HMI operation – Acknowledge error – DIO operation – Acknowledge error – IO-Link operation – Point-to-point operation with intermediate position "Pos_{Imp}" – Updating firmware – Updating parameter set – Data backup (data storage) – Save parameters

Tab. 20: Overview of firmware versions and IODD versions

10.2.1.1 Updating firmware (from IODD version V1.2.6)

⚠ WARNING

Risk of Injury due to Unexpected Movement of Components

For vertical or slanted mounting position: when power is off, moving parts can travel or fall uncontrolled into the lower end position.

- Bring moving parts of the product into a safe end position or secure them against falling.

Requirement for the IO-Link master/application software

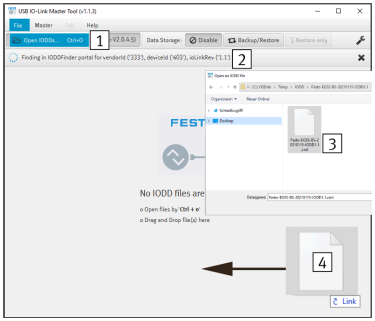
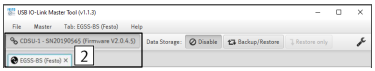
– The IO-Link Master must support the IO-Link standard 'IO-Link BLOB Transfer & Firmware Update V1.1', e.g. Festo USB IO-Link Master CDSU-1 with firmware version V2.1.0.11 or higher.
– The application software checks the 'Profile characteristic' attribute in the IODD for the value 0x0031 (49) for the profile identifier of the firmware update profile. If the check is successful, the 'Firmware update (Profile)' tab is active.

- In the application software, the "0x43BE.0 'Hardware Identification Key (HW_ID_Key)'" parameter is checked for the character string 'BOOTLOAD_FW' and compared with the IOLFW file in use. If the check is successful, the file can be written to the drive.
- An IODD device description file with version V1.2.6 or higher is used in the application software.

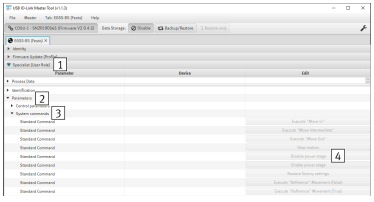
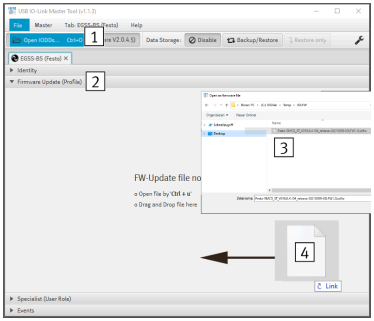
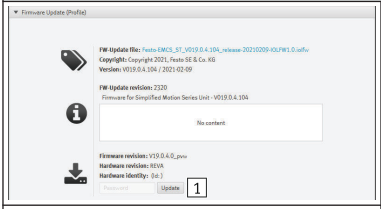
With the Festo IO-Link Master CDSU-1 an update of the firmware in the integrated drive can take up to 30 minutes and must not be interrupted, e.g. by switching off the device or by exiting the software. This time can vary greatly if other IO-Link masters are used. If the firmware is updated incorrectly or improperly, the device may become unusable (service required).
All HMI buttons are blocked and all LED indicators flash blue during the firmware update.

The table shows all steps for updating the firmware using the application software of the Festo USB IO-Link Master CDSU-1 as an example.

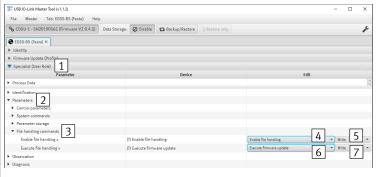
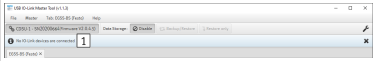
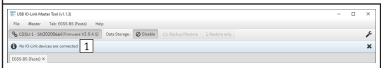
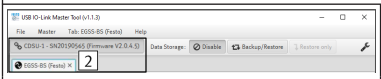
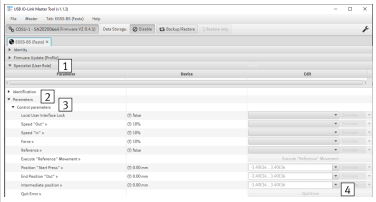
Steps for updating the firmware

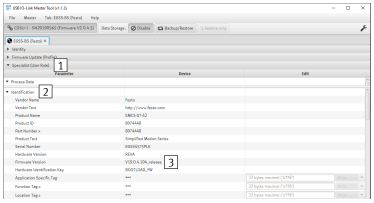
1. Start the application software.	
	– Run the app.
2. Open the IODD file (device description file).	
	Variants for opening the file: – Open the 'File' tab and run the 'Open IODDs...' 1 sub-menu. – Via the automatic search 2.[1)] – Via the key combination Strg + o 3. – Per Drag-&-Drop 4.
3. Establish a connection to the IO-Link Master.	
	– Press the 'Connect' 1 button.
	– The connection is established 2.

Steps for updating the firmware

4. Switch off power stage (optional from version V19.0.4.107).
 – Open the ‘Specialist (User Role)’ 1 tab. – Open the ‘Parameters’ 2 and ‘System commands’ 3 submenus. – In the ‘Standard Commands’ press the ‘Disable power stage’ 4 button.
5. Open the firmware file, e.g. Festo-EMCS_ST_V019.0.4.107_release-20210315-IOLFW1.0.iolfw.
 – Open the ‘Firmware Update (Profile)’ 2 tab. Variants for opening the file: – Open the ‘File’ tab and run the ‘Open IODDs...’ 1 sub-menu. – Via the key combination ‘Strg + u’ 3. – Per Drag-&-Drop 4.
6. Upload the firmware file to the integrated drive.
 – Press the ‘Update’ 1 button.
 – The firmware is transferred 2, ≈ 30 minutes.
 – The transfer is successfully completed 3.

Steps for updating the firmware

7. Update the firmware file in the integrated drive.
up to Version V16.0.18.92
 – Requirement: power stage is deactivated. – Open the ‘Specialist (User Role)’ 1 tab. – Open the ‘Parameters’ 2 and ‘File handling commands’ 3 submenus. – In the ‘Enable file handling’ parameter select the value ‘Enable file handling’ 4 and press the ‘Write’ 5 button. – In the ‘Execute file handling’ parameter select the value ‘Execute firmware update’ 6 and press the ‘Write’ 7 button.
 – The firmware update is started and then a restart is executed. – The connection to the IO-Link master is interrupted 1.
from version V19.0.4.107
 – The power stage switches off automatically. – The firmware update is started automatically and then the system is restarted. – The connection to the IO-Link master is interrupted 1.
All versions
 – After a successful update, the connection to the IO-Link master is automatically restored 2.
8. Acknowledge error if an error is pending.
 – Open the ‘Specialist (User Role)’ 1 tab. – Open the ‘Parameters’ 2 and ‘Control parameters’ 3 submenus. – In the parameter ‘Quit Error’ press the ‘Quit Error’ 4 button. – The cause of error 0x0064 is eliminated by an active save process.

Steps for updating the firmware	
9. Check the firmware version.	
	– Open the ‘Specialist (User Role)’ 1 tab. – Open the ‘Identification’ 2 submenu. – Check the current version in the ‘Firmware Version’ 3 parameter.

1) The use of the function depends on the application software.

Tab. 21: Steps for updating the firmware

10.2.1.2 Diagnostic messages when updating the firmware

The table shows all diagnostic messages that may be shown during the firmware update.

Event code (IO-Link)	**Description**	**LED** C/Q	**Error code** hex (dec)
0x1810	Firmware invalid. Remedy – Repeat transmission of firmware package.	 red light	0x00B7 (183)
0x1811	Firmware incompatible. Remedy – Check hardware and firmware versions. – Repeat transmission of firmware package.		0x00B8 (184)
0x1812	Firmware save location invalid. Remedy – Restart device. – Servicing required.		0x00B9 (185)
0x1813	Firmware save location empty. Remedy – Restart device. – Servicing required.		0x00BA (186)
0x1814	Firmware update not allowed. Remedy – Switch off power stage.		0x00BB (187)
0x1815	Firmware package in use. Remedy – Repeat transmission of firmware package.		0x00BC (188)

Event code (IO-Link)	Description	LED C/Q	Error code hex (dec)
0x1816	System error during firmware update.	 red light	0x00BD (189)
	Remedy – Repeat transmission of firmware package. – Servicing required.		
0x1817	Firmware update failed.		0x00BE (190)
	Remedy – Repeat transmission of firmware package. – Servicing required.		

Tab. 22: "Firmware error" diagnostic messages

10.2.2 Parameter set

10.2.2.1 Updating parameter set (from firmware version v19.0.4.107_release)

⚠ WARNING

Risk of Injury due to Unexpected Movement of Components

For vertical or slanted mounting position: when power is off, moving parts can travel or fall uncontrolled into the lower end position.

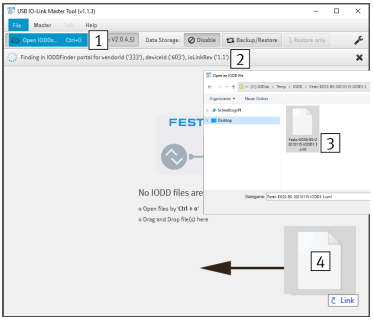
- Bring moving parts of the product into a safe end position or secure them against falling.

The integrated drive supports the update of the parameter set after a device replacement. The parameter set contains the factory settings of the drive system. Drive system-dependent parameters, such as maximum payload of the mechanism, are determined at the first homing and stored.
The table shows all steps for updating the parameter set using the application software of the Festo USB IO-Link Master CDSU-1 as an example.

Steps for updating the parameter set	
1. Start the application software.	
	– Run the app.

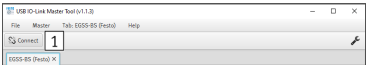
Steps for updating the parameter set

2. Open the IODD file (device description file).

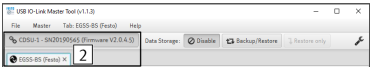


Variants for opening the file:
- Open the ‘File’ tab and run the ‘Open IODDs...’ 1 sub-menu.
- Via the automatic search 2.[1)]
- Via the key combination Strg + o 3.
- Per Drag-&-Drop 4.

3. Establish a connection to the IO-Link Master.

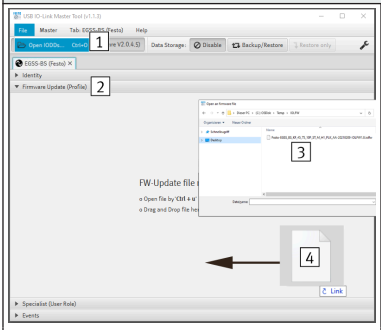


- Press the ‘Connect’ 1 button.



- The connection is established 2.

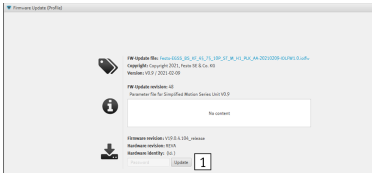
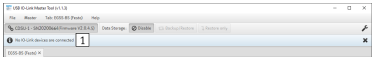
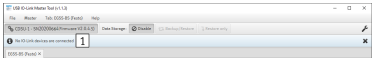
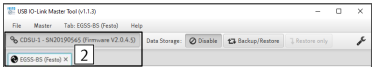
4. Open the parameter set file, e.g. Festo-EGSS_...-20210209-IOLFW1.0.iolfw.



- Open the ‘Firmware Update (Profile)’ 2 tab.

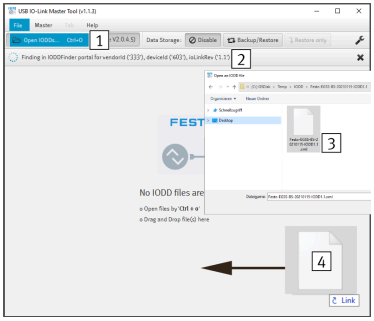
Variants for opening the file:
- Open the ‘File’ tab and run the ‘Open IODDs...’ 1 sub-menu.
- Via the key combination ‘Strg + u’ 3.
- Per ‘Drag-&-Drop’ 4.

Steps for updating the parameter set

5. Upload the parameter set file to the integrated drive.
 – Press the ‘Update’ 1 button.
 – The parameter set is transmitted 2.
 – The transfer is successfully completed 3.
6. Update the parameter set file in the integrated drive.
up to Version V16.0.18.92
 – Perform a manual restart via a power OFF/ON of the logic voltage L_+ [Logic, Pin 1]. – The connection to the IO-Link master is interrupted 1.
from version V19.0.4.107
 – An automatic restart is executed. – The connection to the IO-Link master is interrupted 1.
All versions
 – After successfully loading the parameter file, the connection to the IO-Link Master is automatically re-established 2 or it must be established manually ➔ step 3 "Establish a connection to the IO-ink Master".

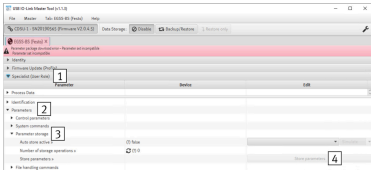
Steps for updating the parameter set

7. Open the IODD file of the drive unit (device description file).



Variants for opening the file:
- Open the ‘File’ tab and run the ‘Open IODDs...’ 1 sub-menu.
- Via the automatic search 2.[1)]
- Via the key combination ‘Strg + o’ 3.
- Per ‘Drag-&-Drop’ 4.

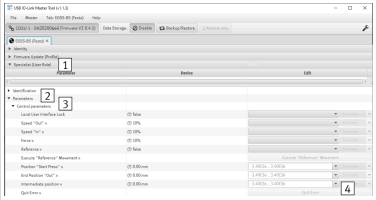
8. Eliminate incompatibility errors. Only if the error in question is displayed.



With error message "Parameter package download error - parameter set incompatible".
- Upload the parameter set to the integrated drive again and update it in the drive.
  ➔ 5. Upload the parameter set file to the integrated drive.
  ➔ 6. Update the parameter set file in the integrated drive.
- Acknowledge error if an error is pending.
  ➔ Open the "Specialist (user role) tab.
  ➔ Open the "Parameters" and "Control parameters" submenus.
  ➔ Press the "Acknowledge error " button.
- Save parameters/Store parameters.
  ➔ Open the "Specialist (user role)" 1 tab.
  ➔ Open the "Parameters" 2 and "Save parameters" 3 tab.
  ➔ Press the "Save parameter" 4 button in the "Save parameters" parameter.
- Restart the drive using Power OFF/ON.

Steps for updating the parameter set

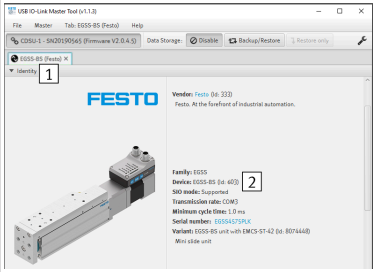
9. Acknowledge error if an error is pending.



- Open ‘Specialist (User Role)’ 1 tab.
- Open the ‘Parameters’ 2 and ‘Control parameters’ 3 submenus.
- Press the ‘Quit Error’ 4 button.

10. Check current status of the parameter set.

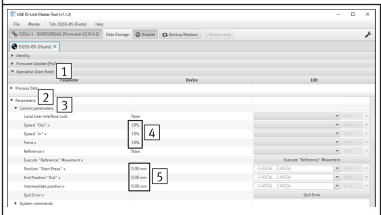
When commissioning a new integrated drive (spare part).



- Open the ‘Identity’ 1 tab.
- Check the current device ID in the ‘Device’ 2 parameter.
  The device ID must correspond to the drive system in use:
  - 0x000259 (601): ELGS-TB
  - 0x00025A (602): ELGS-BS
  - 0x00025B (603): EGSS-BS
  - 0x00025C (604): ELGE-TB
  - 0x00025D (605): ERMS
  - 0x00025E (606): EPCS-BS
  - 0x00025F (607): EPCE-TB

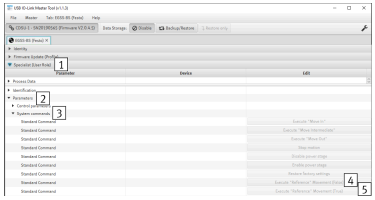
The parameter set file was not updated successfully with 0x000258 (600), EMCS-YY-ST spare part. Repeat the sequence from step 4 "Open the parameter set file".

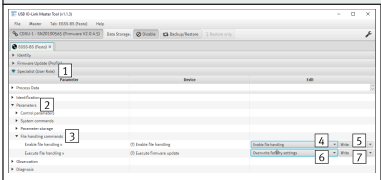
When commissioning a used integrated drive.



- Open ‘Specialist (User Role)’ 1 tab.
- Open the ‘Parameters’ 2 and ‘Control parameters’ 3 submenus.
- Default setting of the following values:
  - ‘Speed "In"’, ‘Speed "Out"’ and ‘Force’ = 10% 4.
  - ‘Position "Start Press"’, ‘End Position "Out"’ and ‘Intermediate position’ = 0.00 mm/0.0 ° 5.

Steps for updating the parameter set	
11. Initialise end positions "Lim_{In}/Lim_{Out}" and reference end position "Ref".	

	– Open ‘Specialist (User Role)’ 1 tab.
	– Open the ‘Parameters’ 2 and ‘System commands’ 3 submenus.
	– Execute one of the two ‘Standard Command’:
	  – Press ‘Execute "Reference" Movement (False)’ 4 (= factory setting).
	  – Press ‘Execute "Reference" Movement (True)’ 5.

12. Save parameter set as factory setting.	
	– Open the ‘Specialist (User Role)’ 1 tab. – Open the ‘Parameters’ 2 and ‘File handling commands’ 3 submenus. – In the ‘Enable file handling’ parameter select the value ‘Enable file handling’ 4 and press the ‘Write’ 5 button. – In the ‘Execute file handling’ parameter select the value ‘Overwrite factory settings’ 6 and press the ‘Write’ 7 button.

1) The use of the function depends on the application software.

Tab. 23: Steps for updating the parameter set

10.2.2.2 Diagnostic messages when updating the parameter set

The table shows all diagnostic messages that may be shown when updating the parameter set.

Event code (IO-Link)	**Description**	**LED** C/Q	**Error code** hex (dec)
0x1820	Parameter set not found	 red light	0x0061 (97)
	Remedy – Check selection of parameter set		
0x1821	Parameter set invalid		0x0062 (98)
	Remedy – Overwrite parameter set (save) ➔ Tab. 23 Steps for updating the parameter set, 8. Eliminate incompatibility error.		

Event code (IO-Link)	Description	LED C/Q	Error code hex (dec)
0x1822	Parameter set incompatible	 red light	0x0063 (99)
	Remedy – Overwrite parameter set (save) ➔ 10.2.2.1 Updating parameter set (from firmware version v19.0.4.107_release), 8. Eliminate incompatibility error.		
0x1823	Parameter not found		0x0064 (100)
	Remedy – Overwrite parameter set (save) ➔ Tab. 23 Steps for updating the parameter set, 8. Eliminate incompatibility error.		

Tab. 24: "Parameter set error" diagnostic messages

10.2.3 Data backup ‘Data Storage’

The integrated drive supports data backup of predefined application data (identification parameters and device data) in the connected IO-Link master. After a device replacement, the application data saved in the IO-Link master are automatically restored to the new functionally and design identical devices. Before transferring the application data, the compatibility of the new device is checked against the device ID. The validity of the parameter values position ‘Start Press’, ‘End Position "Out"’ and ‘Intermediate position’ of the new drive system is checked with a final homing with end position detection.

The following ‘Data Storage’ functions in the IO-Link Master can be controlled via the application software:

- ‘Disable’:
  - Data backup: no application data are saved in the IO-Link Master.
  - Device replacement: the new device has the functionality and behaviour of the factory setting or the functionality and behaviour of the last data backup in the replaced device.
- ‘Backup/Restore’:
  - Data backup: every application data change is automatically saved in the IO-Link Master.
  - Device replacement: the new device has the same functionality and behaviour as the replaced device.
- ‘Restore only’:
  - Data backup: the current status of the application data is saved in the IO-Link Master.
  - Device replacement: the new device has the functionality and behaviour of the last manually performed data backup in the replaced device.

Automatic data backup (‘Backup/Restore’ active) can result in very high data traffic with the IO-Link Master and should only be activated if required.

The table shows all parameters that are transferred when data storage is executed.

Force control ‘Force’

Force is controlled and evaluated by closed-loop control of the motor current. A torque level or a linear force can be determined from the level of current measured depending on the mechanism of the drive. The target is set as a percentage of the rated motor current and may deviate from the actual force on the drive unit. If force levels are set low, the influence of friction in the system on the running behaviour and the actual force on the drive unit must also be taken into account.

Index. Subindex	Name	Description	Data type (Length)
Identification parameters			
0x0018.0 (24.0)	‘Application Specific Tag’	Text field for application information, max. 32 characters.	String (≤32 bytes)
0x0019.0 (25.0)	‘Function Tag’	Text field for function information, max 32 characters.	String (≤32 bytes)
0x001A.0 (26.0)	‘Location Tag’	Text field for location information, max. 32 characters.	String (≤32 bytes)
Device data			
0x0100.0 (256.0)	‘Speed "In"’	10-stage velocity specification from the maximum value for the "Mov_{In}" motion to the reference end position "Ref"/end position "Lim_{In}". – 1 = 10% (default) ... 10 = 100% ➔ Instruction manual for the drive system, technical data.	UInteger8 (1 bytes)
0x0101.0 (257.0)	‘Speed "Out"’	10-stage velocity specification from the maximum value for the "Mov_{Out}" motion to the end position "Lim_{Out}". – 1 = 10% (default) ... 10 = 100% ➔ Instruction manual for the drive system, technical data.	UInteger8 (1 bytes)

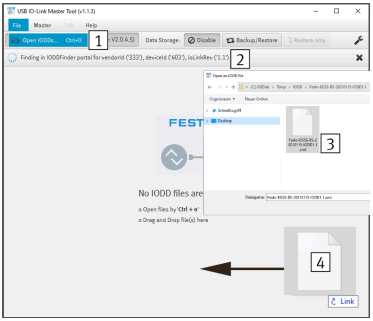
Index. Subindex	Name	Description	Data type (Length)
0x0102.0 (258.0)	‘Force’	10-step force/torque specification for the force-controlled "Mov_{Out}" motion from the "$Pos_{Start\ Press}$" position to the "Lim_{Out}" end position. – 1 = 10% (default) ... 10 = 100% ➔ Instruction manual for the drive system, technical data.	UInteger8 (1 bytes)
0x0103.0 (259.0)	‘Reference’	Position of the reference end position "Ref" after homing has been completed. Linear drive systems: – true: facing away from motor – false: facing motor Rotary drive systems (ERMS: view to the rotating plate): – true: right – false: left	BooleanT (1 bytes)
0x0105.0 (261.0)	‘Position "Start Press"’	Stroke or angle of rotation distance from the "Start Press" position to the reference end position "Ref" (the drive changes from the "$Pos_{Start\ Press}$" position to the force-controlled movement). Linear drive systems: – Length specification [mm] x 0.01 Rotary drive systems: – Angle specification [°] x 0.1	Float32T (4 bytes)

Index. Subindex	Name	Description	Data type (Length)
0x0106.0 (262.0)	‘End Position "Out"’	Stroke or rotation angle distance of the "Lim_{Out}" end position to the reference end position "Ref" (the drive stops at the "Lim_{Out}" end position and waits for the next motion command). Linear drive systems: – Length specification [mm] x 0.01 Rotary drive systems: – Angle specification [°] x 0.1	Float32T (4 bytes)
0x0108.0 (264.0)	‘Intermediate Position’	Stroke or rotation angle distance of the intermediate position "Pos_{Imp}" to the reference end position "Ref" (the drive stops in the "Pos_{Imp}" intermediate position and waits for the next motion command). Linear drive systems: – Length specification [mm] x 0.01 Rotary drive systems: – Angle specification [°] x 0.1	Float32T (4 bytes)

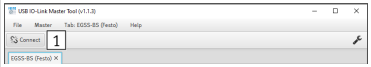
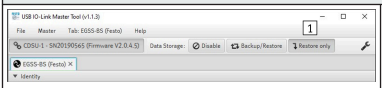
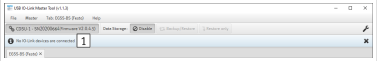
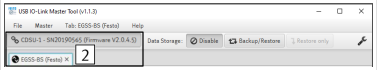
Tab. 25: ‘Data Storage’ parameter

10.2.3.1 Perform data backup ‘Data Storage’ (from firmware version v19.0.4.107_release)

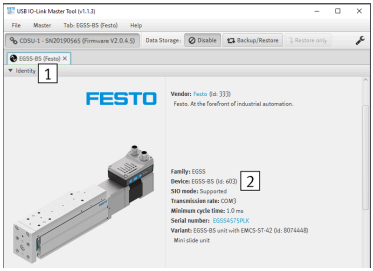
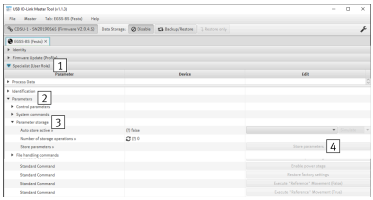
The table shows all steps for executing the ‘Data Storage’ function using the application software of the Festo USB IO-Link Master CDSU-1 as an example.

Steps for executing the ‘Data Storage’ function	
1. Start the application software	
	– Run the app.
2. Open the IODD file (device description file)	
	Variants for opening the file: – Open the ‘File’ tab and run the ‘Open IODDs...’ 1 sub-menu. – Via the automatic search 2. The use of the function depends on the application software. – Via the key combination ‘Strg + o’ 3. – Per ‘Drag-&-Drop’ 4.

Steps for executing the ‘Data Storage’ function

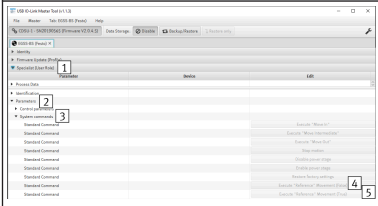
3. Establish a connection to the IO-Link Master
 – Press the ‘Connect’ 1 button.
 – The connection is established 2. – Default setting: the ‘Data Storage’ function is deactivated — the ‘Disable’ 3 button is active.
4. Activate automatic saving (‘Backup’)
 – In the ‘Data Storage’ tab, press the ‘Backup/Restore’ 1 button. – The predefined application data is automatically saved in the IO-Link Master with every change.
5. Activate one-time storage (‘Restore only’)
 – In the ‘Data Storage’ tab, press the ‘Restore only’ 1 button. – The predefined application data are saved once in the IO-Link master.
6. Replace device
 – Disconnect the connection to the IO-Link Master. – Disconnect the electrical connections at the integrated drive. – The connection to the IO-Link master is interrupted 1.
 – Electrically connect the new integrated drive to the IO-Link Master. – The connection to the IO-Link Master is automatically re-established 2. – After a successful compatibility check of the device ID "0x0000.0A … 0C, Device ID1 … ID3 ", the application data are automatically transferred to the integrated drive.

Steps for executing the ‘Data Storage’ function

7. Check the current status of the application data	
	– Open the ‘Identity’ 1 tab. – Check the current device ID in the ‘Device’ 2 parameter. The device ID must correspond to the drive system in use. – 0x000259 (601): ELGS-TB – 0x00025A (602): ELGS-BS – 0x00025B (603): EGSS-BS – 0x00025C (604): ELGE-TB – 0x00025D (605): ERMS – 0x00025E (606): EPCS-BS – 0x00025F (607): EPCE-TB
8. Save application data	
	– Open the ‘Specialist (User Role)’ 1 tab. – Open the ‘Parameters’ 2 and ‘Store parameters’ 3 submenus. – In the parameter ‘Store parameters’ press the ‘Store parameters’ 4 button.

Steps for executing the ‘Data Storage’ function

9. Reference the new drive system	

	– Open the ‘Specialist (User Role)’ 1 tab.
	– Open the ‘Parameters’ 2 and ‘System commands’ 3 submenus.
	– Execute one of the two ‘Standard Command’:
	  – Press ‘Execute "Reference" Movement (False)’ 4 (= factory setting).
	  – Press ‘Execute "Reference" Movement (True)’ 5.
	– Note:
	After successful homing with end position determination, the transferred values of the parameters 0x0105.0 ‘Position "Start Press"’, 0x0106.0 ‘End Position "Out"’ and 0x0108.0 ‘Intermediate position’ only retained if they are within the value range of the parameter 0x0106.0 ‘End Position "Out"’ of the new drive system. If exceeded, the transferred values are replaced by the new derived values of the parameter 0x0106.0 ‘End Position "Out"’.

Tab. 26: Steps for executing the ‘Data Storage’ function

10.2.4 Factory settings

The EMCS-ST can be reset to factory settings in two ways:
– Via the IO-Link parameter 0x0002 ‘Restore factory settings’, value 0xCD" ➔ 15.2.4 System parameters.
– By simultaneously pressing and holding all three pushbutton actuators for at least 10 seconds with logic voltage present (possible in all operating modes).
  After 10 seconds all 6 LED displays for the parameters light and the logic voltage must be switched off and on again.

ⓘ

After reset to the factory settings, the drive must be homed ➔ 10.3.2 Homing with end position determination.

After a reset to the factory settings, the following settings become active, unless the user has changed them:
– Parameter ‘Speed Out’: level 1 (10% of the maximum value)
– Parameter ‘Speed In’: level 1 (10% of the maximum value)
– Parameter ‘Force’: level 1 (10% of the maximum value)
– Parameter ‘Start Press’: maximum possible value of the relevant mechanism
– Parameter ‘Intermediate Position’: maximum possible value of the relevant mechanism

- Reference end position➔ 10.1.2 Dimension reference system:
  - Linear drive system: end position facing the motor, retracted
  - Rotary drive system: left
- Parameter ‘End Position Out’: maximum possible value of the relevant mechanism

10.2.5 Switch-on behaviour

The switch-on behaviour of the EMCS-ST depends on the following conditions:
- Commissioning
- Restart (error acknowledgement)
- Logic voltage failure [Logic]
- Load voltage failure [Power]
- Power failure [Logic] and [Power]

The logic voltage [Logic] ≈ must be switched on 50 ms after the load voltage [Power] when switching on the power supplies.
If the logic voltage is switched on before the load voltage, the EMCS-ST starts with an error that must be acknowledged.

Timing: switch-on behaviour
The diagram shows the switch-on behaviour of the EMCS-ST from switching on the power supplies to reaching the "Ready for operation (system not referenced)" status.

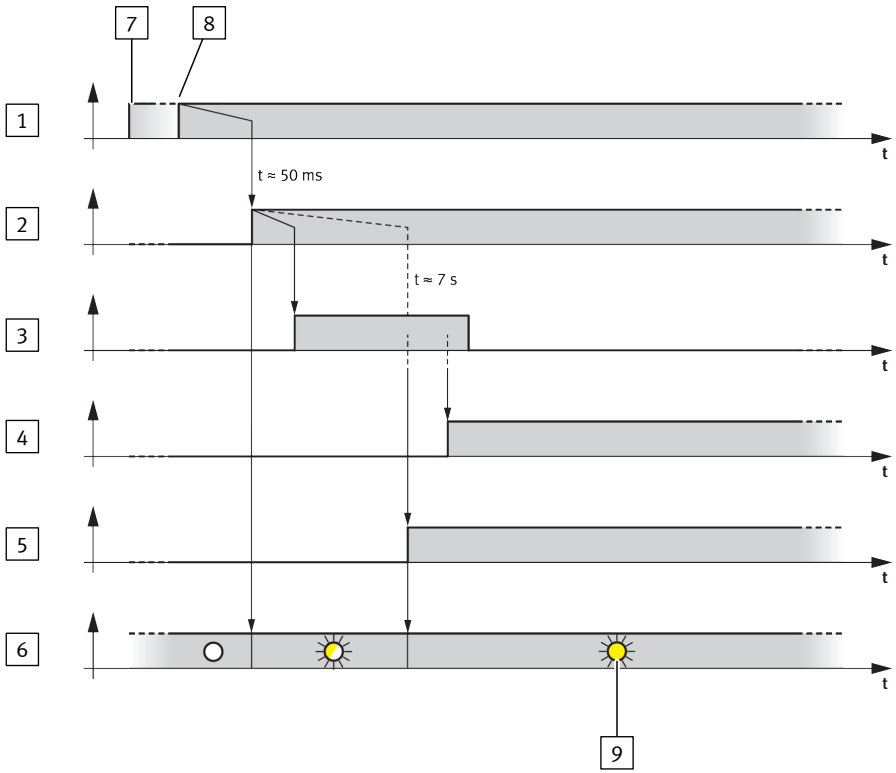


Fig. 10: Switch-on behaviour of the EMCS-ST

1 [Power] Power ON (24V DC)

2 [Logic] Power ON (24V DC)

3 Initialisation

4 "DIO" master control

5 Power stage active (position-controlled)

6 LED C/Q

7 Restart or logic voltage failure [Logic]

8 (Initial) commissioning, load voltage failure [Power] or mains failure [Logic] [Power]

9 Warning: system not referenced

10.2.6 Switch-off behaviour

The switch-off behaviour of the EMCS-ST in the event of a voltage interruption depends on the type of failure:

- Logic voltage failure [Logic]
- Load voltage failure [Power]
- Power failure [Logic] and [Power]

Timing: switch-off behaviour in the event of logic voltage failure

The diagram shows the switch-off behaviour of the EMCS-ST when the logic voltage fails or is disconnected.

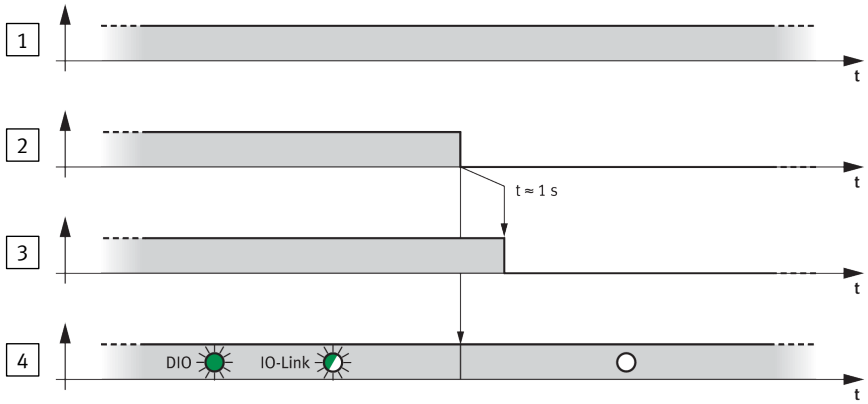


Fig. 11: Switch-off behaviour in the event of a logic voltage failure

1 [Power] Power ON (24V DC)

2 [Logic] Power ON ➔ OFF (24V DC)

3 Power stage active (position-controlled)

4 LED C/Q

Timing: switch-off behaviour in the event of load voltage failure

The diagram shows the switch-off behaviour of the EMCS-ST when the load voltage fails or is disconnected.

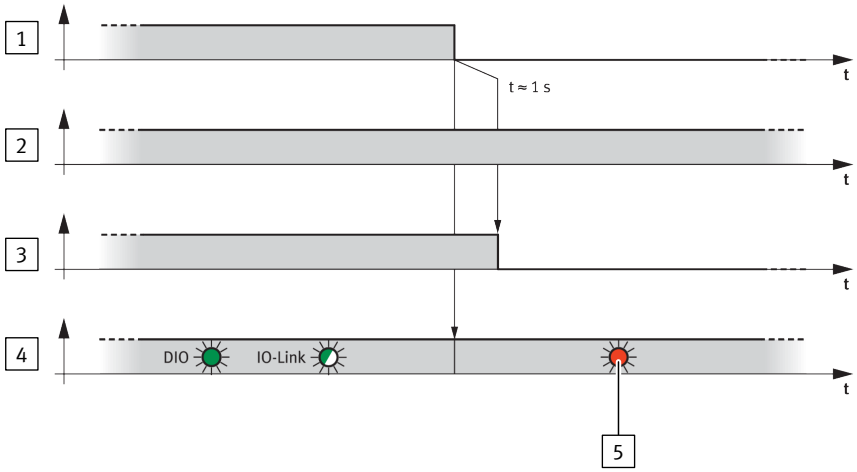


Fig. 12: Switch-off behaviour in the event of load voltage failure

1 [Power] Power ON ➔ OFF (24V DC)

2 [Logic] Power ON (24V DC)

3 Power stage active (position-controlled)

4 LED C/Q

5 Error: load voltage undersupply or not connected

Timing: switch-off behaviour in case of power failure

The diagram shows the switch-off behaviour of the EMCS-ST when the mains voltage fails or is disconnected.

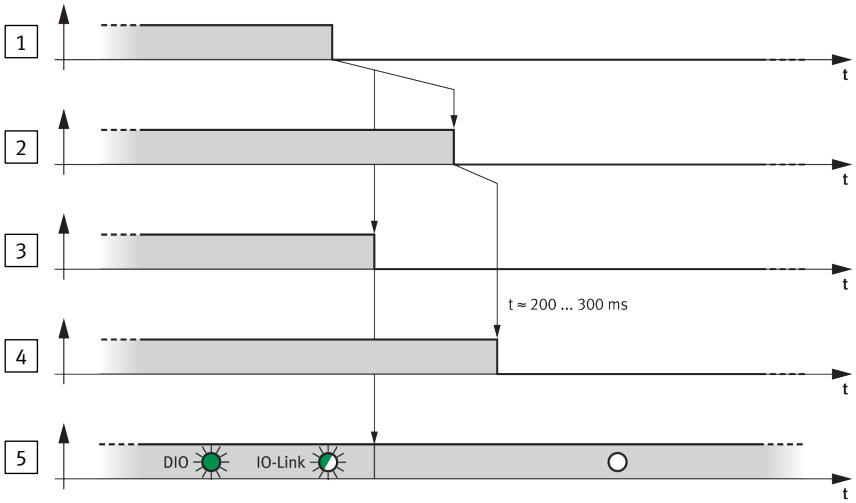


Fig. 13: Switch-off behaviour in case of power failure

1 Mains Power ON ➔ OFF (230 V AC)

2 [Power] Power ON (24V DC)

3 [Logic] Power ON (24V DC)

4 Power stage active (position-controlled)

5 LED C/Q

10.2.7 Restart

Function

The restart includes the following functions:

- Acknowledge an error
- Re-initialise the reference end position
- Update the parameter set in the integrated drive ➔ 10.2.2 Parameter set

Acknowledge error

In the HMI, DIO or IO-Link mode, a restart (Reset) acknowledges all errors and deletes them from the diagnostic memory.

The restart is executed via Power OFF/ON of the logic voltage L_+ [Logic, Pin 1].

Additional information on acknowledging errors ➔ 12.2.1 Acknowledge error

---

An active error message is only deleted from the diagnostic memory if the cause of the error has been cleared.

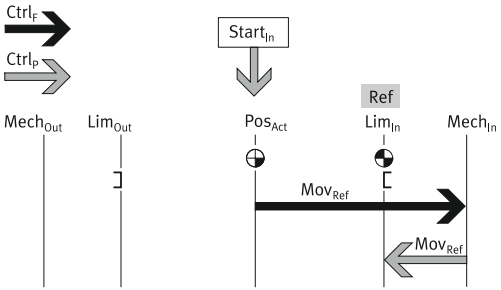
Re-initialise reference end position "Ref"
The referencing of the reference end position is lost on Power OFF of the logic voltage L_+ [Logic, Pin 1]. After every restart the position of the reference end position "Ref" is re-initialised at the ‘Speed Ref’ velocity with the first motion task.

Homing after a restart as a function of the positioning task

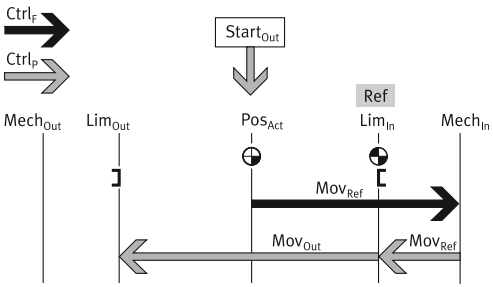
Sequence

- Mov_{Ref}: force-controlled movement $Ctrl_F$ against mechanical stop "$Mech_{In}$"
- Mov_{Out}: position-controlled movement $Ctrl_P$ to the reference end position "Ref"
- Travel to the target position as a function of the positioning task
  - No travel, end position "Lim_{In}" reached
  - Mov_{Out}: position-controlled movement $Ctrl_P$ to the end position Lim_{Out}
  - Mov_{Imp}: position-controlled travel $Ctrl_P$ to the intermediate position Lim_{Imp} (IO-Link only)

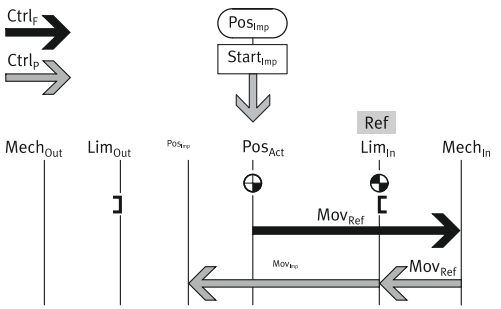
$Start_{In}$ positioning task to the end position Lim_{In}



$Start_{Out}$ positioning task to the end position Lim_{Out}

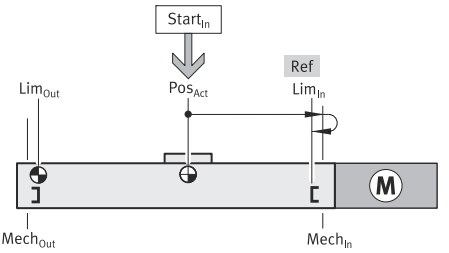
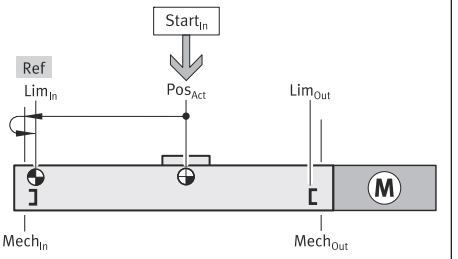
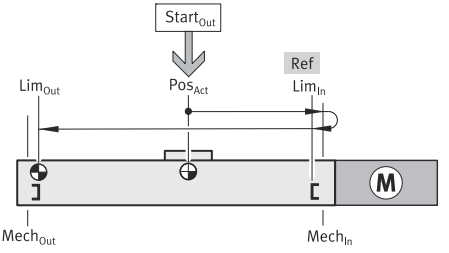
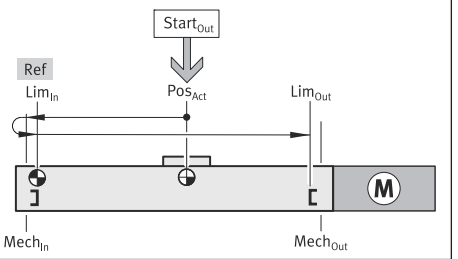
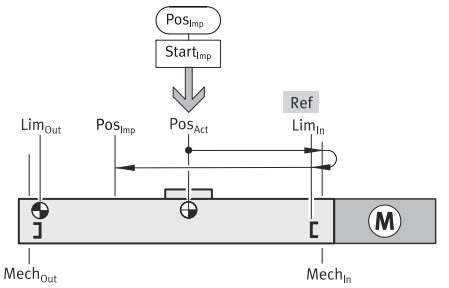
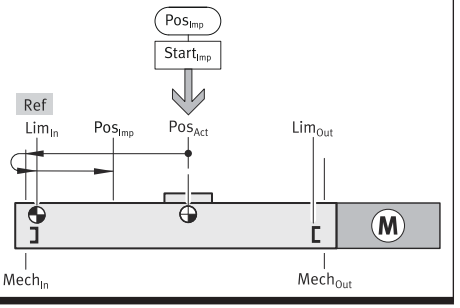


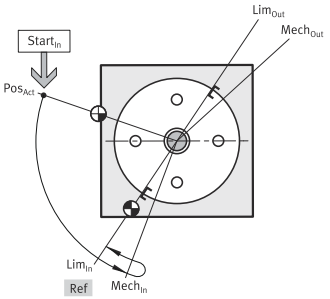
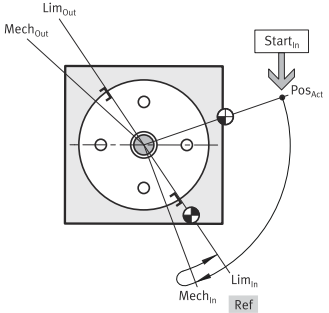
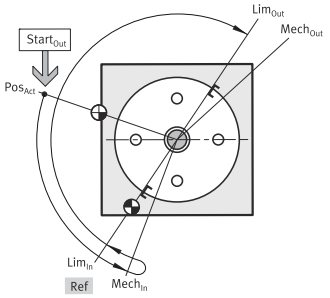
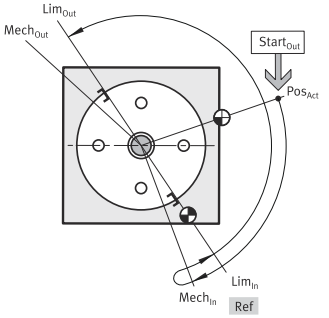
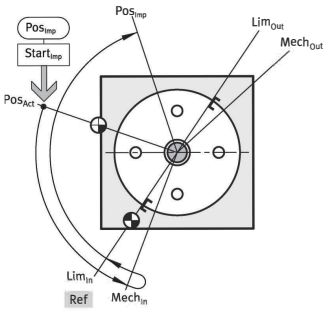
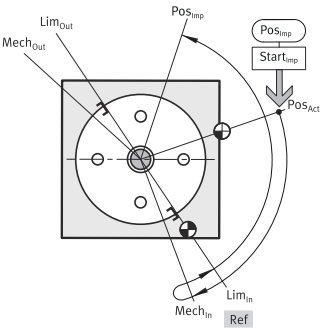
$Start_{Imp}$ positioning task to the intermediate position Pos_{Imp} (IO-Link only)



Tab. 27: Initialise restart sequence with reference end position "Ref"

Restart dependent on reference end positions "Ref" and positioning task

Overview of the positioning tasks with initialisation of the reference end position "Ref"	
Parameterised reference end positions "Ref	
Factory setting	
– HMI: 'Reference' menu – IO-Link: 0x0103.0 'Reference' = false	– HMI: 'Reference' menu – IO-Link: 0x0103.0 'Reference' = true
Motion tasks for linear drive systems	
Reference end position "Ref" facing motor	Reference end position "Ref" facing away from motor
Motion task $Start_{In}$	
	
Motion task $Start_{Out}$	
	
Motion task $Start_{Imp}$ (IO-Link only)	
	

Overview of the positioning tasks with initialisation of the reference end position "Ref"	
Motion tasks for rotary drive systems (ERMS: view of the rotating plate)	
Left reference end position "Ref"	Right reference end position "Ref"
Motion task $Start_{In}$	
	
Motion task $Start_{Out}$	
	
Motion task $Start_{Imp}$ (IO-Link only)	
	

Tab. 28: Restart for linear and rotary drive systems

Timing: travel to end position Lim_{In} ("Ref") after a restart

The diagram shows the status data in DIO and IO-Link operation of the "Mov_{Ref}" homing from the "$Start_{In}$" command to reaching the "Lim_{In}" end position.

Activate positioning task $Start_{In}$

- DIO, digital inputs: DI1 "Mov_{In}" = 1 and DI2 "Mov_{Out}" = 0
- IO-Link, process data: 0x0029.1 = true, 0x0029.2 and 0x0029.5 = false
  IO-Link, system parameter: 0x0002, value = 0xC8 'Execute "Move In"'

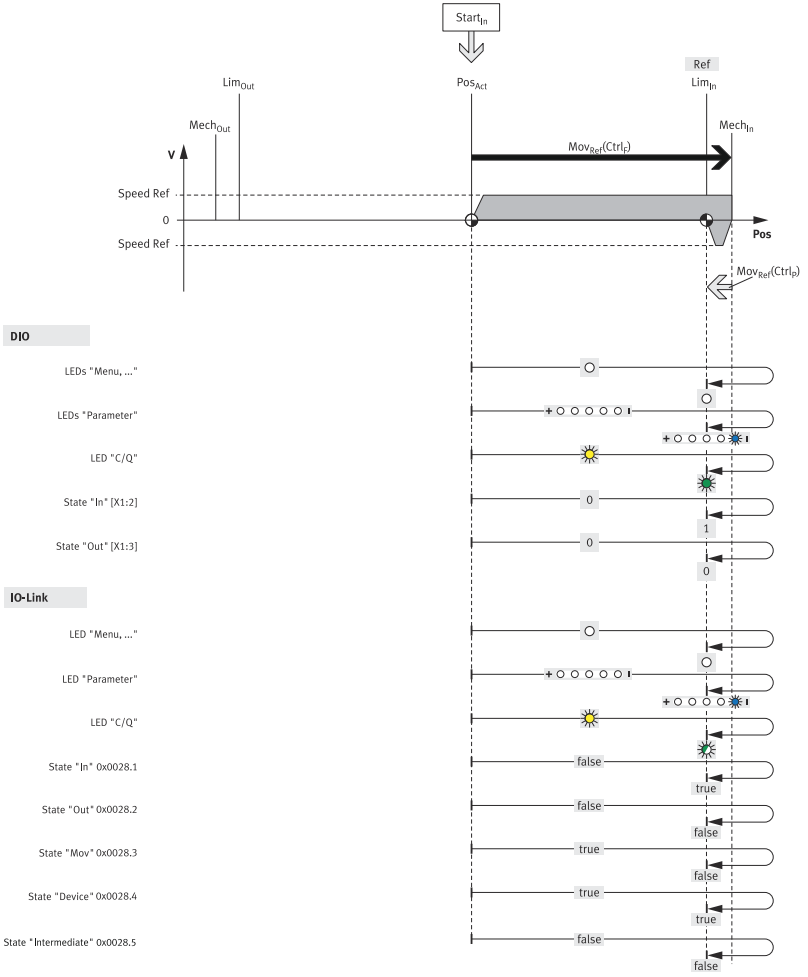


Fig. 14: Travel to end position Lim_{In} ("Ref") after a restart

Timing: travel to end position Lim_{Out} after a restart

The diagram shows the status data in DIO and IO-Link operation of the "Mov_{Ref}" homing and the "Mov_{Out}" motion from the "$Start_{Out}$" command to reaching the "Lim_{Out}" end position.

Activating positioning task $Start_{Out}$

- DIO, digital inputs: DI2 "Mov_{Out}" = 1 and DI1 "Mov_{In}" = 0
- IO-Link, process data: 0x0029.2 = true, 0x0029.1 and 0x0029.5 = false
  IO-Link, system parameter: 0x0002, value = 0xC9 'Execute "Move Out"'

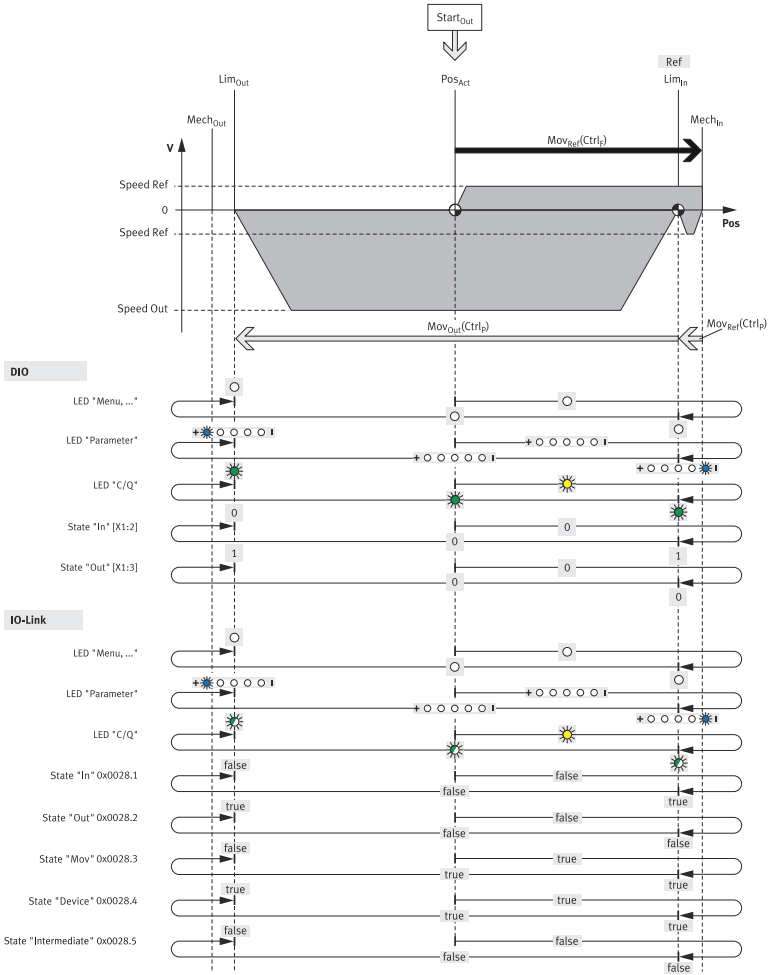


Fig. 15: Travel to end position Lim_{Out} after a restart

Timing: travel to intermediate position Pos_{Imp} after a restart

The diagram shows the status data in the IO-Link mode of the "Mov_{Ref}" homing and the "Mov_{Imp}" motion from the "$Start_{Imp}$" command to the "Pos_{Imp}" intermediate position.

Activating motion task $Start_{Imp}$

– IO-Link, process data: 0x0029.5 = true, 0x0029.1 and 0x0029.2 = false
  IO-Link, system parameter: 0x0002, value = 0xD0 'Execute "Move Intermediate"'

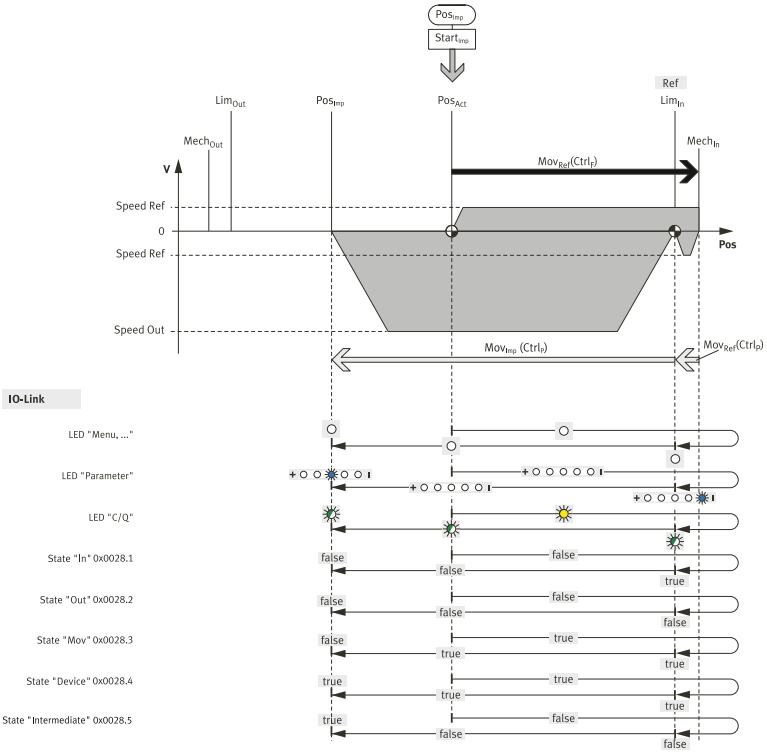


Fig. 16: Move to Pos_{Imp} intermediate position after a restart

10.2.8 Master control

Function

The master control specifies which interface has the authorisation to control the EMCS-ST.
During operation, only one of the following interfaces can be the master control:
- digital inputs/outputs (DIO) [Logic]
- IO-Link (LK) [Logic]
- control and display component (HMI)

The display and operating component (HMI) always has higher priority than the "digital I/O (DIO)" or "IO-Link (LK)" [Logic] control interface.
If the pushbutton actuator lock is released, incoming travel commands are blocked and not executed.

"Digital inputs/outputs (DIO)" or "IO-Link (LK)" master control

After switching on the power supplies and initialising the EMCS-ST, the master control is automatically assigned to the "digital inputs/outputs (DIO)" control interface. The detection of an active IO-Link master causes the master control to switch automatically to the "IO-Link" control interface. If the IO-Link communication is interrupted, the master control automatically returns to the "digital inputs/outputs (DIO)" control interface.

Timing

The diagram shows the automatic transfer of the master control between the "digital inputs/outputs (DIO)" and "IO-Link (LK)" control interfaces.

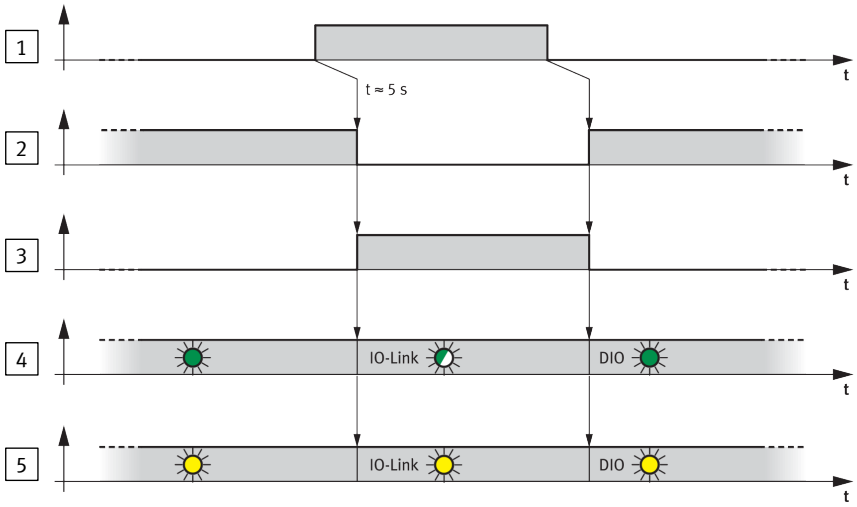


Fig. 17: "Digital inputs/outputs (DIO)" or "IO-Link (LK)" master control

1 IO-Link Master active "control interface [Logic]"

2 "DIO" master control

3 "IO-Link" master control

4 LED C/Q (system referenced)

5 LED C/Q (system not referenced)

"Display and operating component (HMI)" master control

After unlocking the pushbutton actuators (HMI), the master control is automatically assigned to the "display and operating components (HMI)" interface. When the display and operating components (HMI) are locked, the master control automatically switches back to the last active "digital inputs/outputs (DIO)" or "IO-Link (LK)" control interface.

Timing
The diagram shows the transfer of the master control between the "Digital I/O (DIO) or IO-Link (LK)" control interface and the "Display and operating component (HMI)" interface.

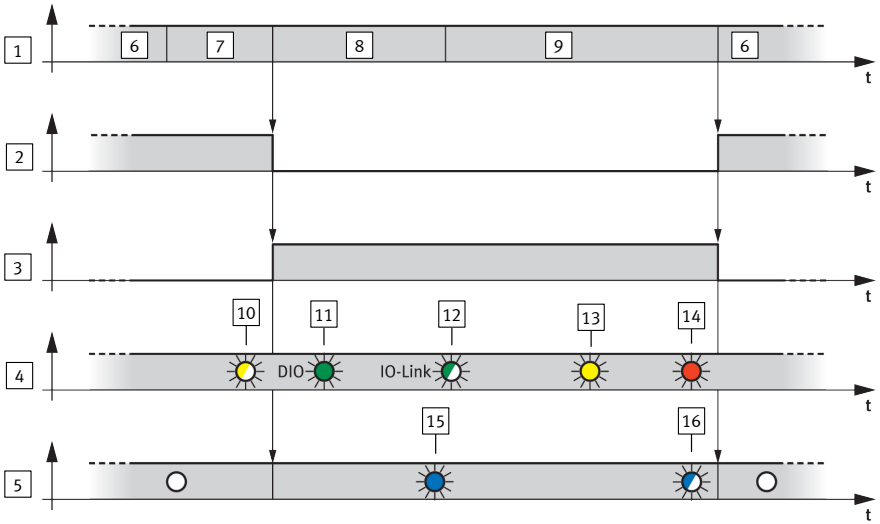


Fig. 18: "Display and operating components (HMI)" master control

1 Pushbutton actuators (HMI)

2 "Control interface [Logic]" master control (digital inputs/outputs (DIO), IO-Link (LK))

3 "[HMI"] master control

4 LED C/Q

5 LED display menu ‘Speed Out’, ...

6 Blocked

7 Unlocking

8 Configuration (user input)

9 Waiting time 15 s (no user input) or blocking ("Edit" 3 s)

10 Initialisation

11 DIO active

12 IO-Link active

13 Warning active or system not yet referenced

14 Error active

15 Menu selection

16 Activate/parameterise/control

10.3 Operating modes

10.3.1 Activation times for the dynamic status change

Dynamic status changes between the following states can be carried out during operation.

- Standstill
  - Lim_{In}: End position "In", position-controlled (output stage active)
  - Lim_{Out}: end position "Out", position-controlled (output stage active)
  - Pos_{Imp}: intermediate position, position-controlled (output stage active), IO-Link only
  - $Pos._{Stop}$: stop position, position-controlled (output stage active)
  - Pos_{Idle}: Idle position: unregulated with switched-off output stage
- Activate positioning task
  - $Start_{In}$: "In" end position positioning task
  - $Start_{Out}$: "Out"/Start Press Position end position positioning task (with press function)
  - $Start_{Imp}$: intermediate position positioning task (IO-Link only)
- Stop/cancel positioning task
  - Stop: stop positioning task
  - Switch off output stage: stop positioning task

The following tables show the activation times for the dynamic status changes.

From "standstill"	**After "activate positioning task"**		
State ...	$Start_{In}$	$Start_{Out}$	$Start_{Imp}$
	DIO – DI1/2 = 1/0	DIO – DI1/2 = 0/1	–
	IO-Link – 0x0029.1/2/5 = true/false/false – 0x0002 = 0xC8	IO-Link – 0x0029.1/2/5 = false/true/false – 0x0002 = 0xC9	IO-Link – 0x0029.1/2/5 = false/false/true – 0x0002 = 0xD0
Lim_{In}			
DIO – DO1/2 = 1/0 IO-Link – 0x0028.1/2/5 = true/false/false	–	20 ms	20 ms
Lim_{Out}			
DIO – DO1/2 = 0/1 IO-Link – 0x0028.1/2/5 = false/true/false	20 ms	–	20 ms
Pos_{Imp}			
DIO – – IO-Link – 0x0028.1/2/5 = false/false/true	20 ms	20 ms	20 ms
$Pos._{Stop}$			
DIO – DO1/2 = 0/0 IO-Link – 0x0028.1/2/5 = false/false/false	20 ms	20 ms	20 ms
Pos_{Break}			
DIO – DO1/2 = 0/0 IO-Link – 0x0028.1/2/5 = false/false/false	20 ms	20 ms	20 ms

Tab. 29: Activation times for the dynamic status change in an active positioning task

From "active positioning task"	**After "stop positioning task or switch off output stage"**		
Move...	Stop (output stage active)	Switch off output stage	
	DIO – DI1/2 = 0/0	DIO – DI1/2 = 1/1	–
	IO-Link – 0x0029.1/2/5 = false/false/false – 0X0002 = 0xCA	IO-Link – 0x0029.1/2/5 ≥ 2 x true	IO-Link – 0X0002 = 0xCB
$Start_{In}$			
DIO – DI1/2 = 1/0 IO-Link – 0x0029.1/2/5 = true/false/false – 0X0002 = 0xC8	20 ms	3 s	20 ms
$Start_{Out}$			
DIO – DI1/2 = 0/1 IO-Link – 0x0029.1/2/5 = false/true/false – 0X0002 = 0xC9	20 ms	3 s	20 ms
$Start_{Intermediate}$			
IO-Link – 0x0029.1/2/5 = false/false/true – 0X0002 = 0xD0	20 ms	3 s	20 ms

Tab. 30: Activation times for the dynamic status change to standstill

10.3.2 Homing with end position determination

10.3.2.1 Function

The connected drive must be homed to a dimension reference system in order to be able to approach the "In/Out end positions or intermediate position" positions.
The factory settings for the reference end positions are:
– Linear drive: reference end position "Ref" facing motor
– Rotary drive: left reference end position "Ref"
Homing of the drive includes:
– Homing with end position determination
  – Linear drive: determining the maximum stroke
  – Rotary drive: determine the maximum swivel range
– Definition of the dimension reference system
– Definition of motion directions
– Definition of display or status information

Reference end position "Ref"
During referencing with end position determination the positions of the mechanical stops $Mech_{In}$/$Mech_{Out}$ are recorded in order to calculate the end positions Lim_{In} ("Ref")/Lim_{Out} for the dimension reference system.
Before running referencing with end position determination to a new reference end position "Ref", the drive is de-energized for a required re-initialisation. Then the power is restored and the process is started.

Homing
With the single-turn encoder, the reference to the reference end position "Ref" in the dimension reference system is only securely retained until a logic voltage interruption (e.g. restart, power failure) occurs.

Homing with end position determination
The homing includes the following steps:
1. Travel to the mechanical stop "$Mech_{In}$" (direction of selected reference end position "Ref").
2. Calculation of the position reference end position "Ref"/end position "Lim_{In}".
3. Travel to the mechanical stop "$Mech_{Out}$" (opposite direction to selected reference end position "Ref").
4. Calculation of the end position "Lim_{Out}" position.
5. Travel to the end position "Lim_{Out}" position.

After a valid homing, the drive remains position-controlled at the "Lim_{Out}" end position and the status is set in the device data 0x0103.0 ‘Reference’. If the integrated drive is replaced or homing is repeated, the status in the parameter 0x0103.0 ‘Reference’ is reset.

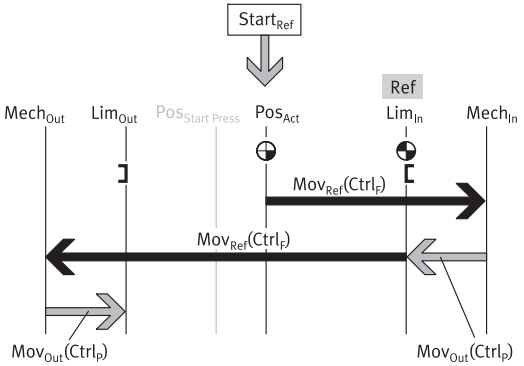
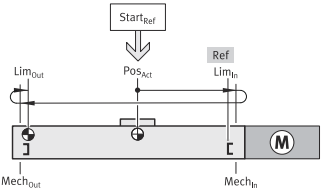
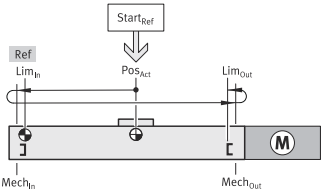
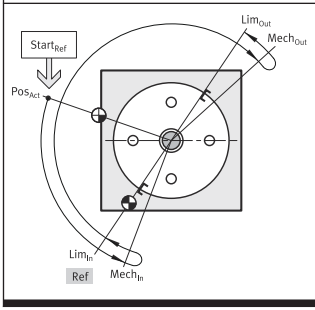
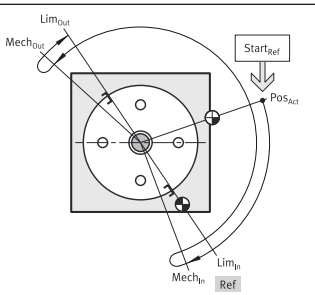


Fig. 19: "Homing with end position determination" sequence

Homing of the drive system as a function of the reference end position "Ref"

Overview of reference end positions "Ref"	
Parameterised reference end positions "Ref	
Factory setting	
– HMI: 'Reference' menu – IO-Link: 0x0103.0 'Reference' = false	– HMI: 'Reference' menu – IO-Link: 0x0103.0 'Reference' = true
Homing with linear drive systems	
Reference end position "Ref" facing motor	Reference end position "Ref" facing away from motor
	

Overview of reference end positions "Ref"	
Homing with rotary drive systems (ERMS: view of the rotating plate)	
Left reference end position "Ref"	Right reference end position "Ref"
	

Tab. 31: Homing of linear and rotary drive systems

10.3.2.2 Parameters

Name	Description	HMI (menu)	IO-Link (Index. Subindex)
'Speed Ref'	Target speed 'Speed Ref' for the "Mov$_{Ref}$" travel. The exact speed depends on the drive mechanism ➔ Technical data of the specific product unit.	1)	1)
a+	Target acceleration for all motions	1)	1)
a–	Target deceleration for all motions	1)	1)
Lim$_{In}$	Position of the "Lim$_{In}$" end position	1)	1)
Lim$_{Out}$	Position of the "Lim$_{Out}$" end position	1)	0x0106.0

1) non-changeable parameter

Tab. 32: Parameters for homing

10.3.2.3 Timing

Timing: homing with end position determination to end position Lim$_{Out}$

The diagram shows the status data in HMI and IO-Link operation of the "Mov$_{Ref}$" homing from the "Start$_{Ref}$" command to reaching the "Lim$_{Out}$" end position.

Activating homing start$_{Ref}$

- HMI: activate 'Reference' menu, parameterise reference end position "Ref" and initiate homing ➔ Fig. 5
- IO-Link, process data: parameterise reference end position "Ref" 0x0103.0, false (factory setting) or true and initiate referencing movement 0x0104.0 = true
  IO-Link, system parameter: 0x0002, value = 0xCE 'Execute "Reference" Movement (False)', factory setting) or value = 0xCF 'Execute "Reference" Movement (True)'

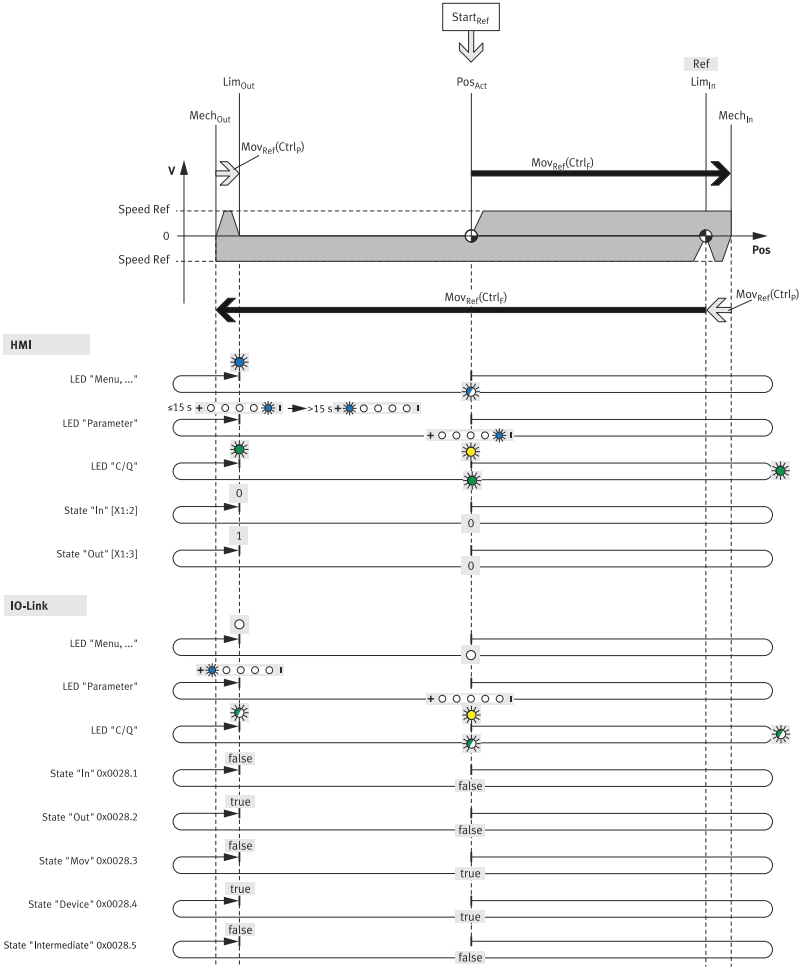


Fig. 20: Initialise homing with end position determination

Timing: stop homing

The diagram shows the status data in HMI and IO-Link operation of homing with end position determination "Mov$_{Ref}$" from the "Stop" command to standstill.

Stop task, activate stop

- HMI: press ←, → or Edit button.
- IO-Link, process data: value change to 0x0029.1, 0x0029.2 and 0x0029.5 = false
  IO-Link, system parameter: 0x0002, value = 0xCA ‘Stop motion’

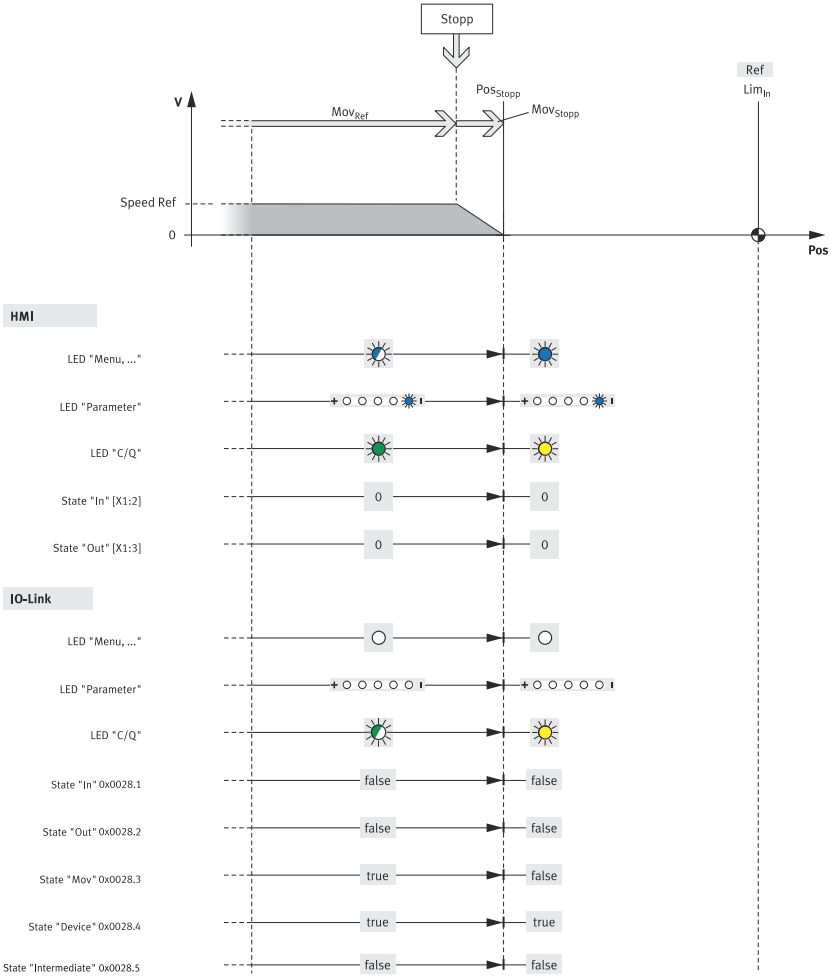


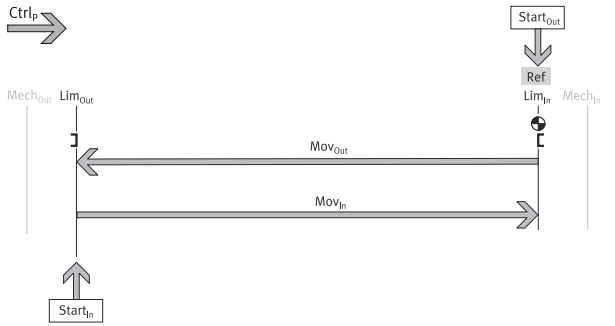
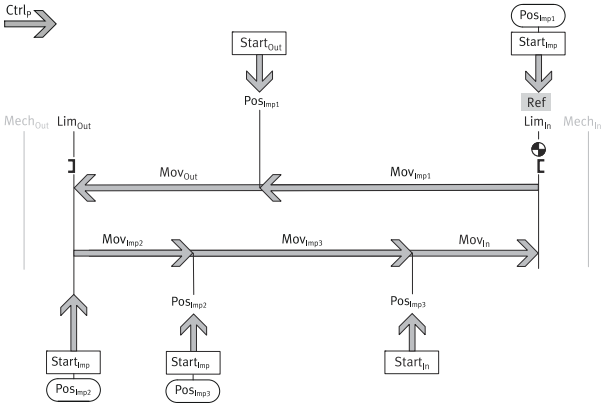
Fig. 21: Stop homing

10.3.3 Simple point-to-point operation

10.3.3.1 Function

For single point-to-point operation the drive can be traversed to the target positions "end positions "Lim_{In}/Lim_{Out} and intermediate positions Pos_{Imp}" (IO-Link only). Multiple intermediate positions can be approached consecutively. The motion for the EMCS-ST is controlled by the "digital inputs/outputs (DIO)" or "IO-Link (LK)" at the [Logic] connection. The "In/Out end positions" positions and the "Mov_{In}/Mov_{Out}" directions of motion of the drive are defined by the "Ref" reference end position. When the positioning task is activated, the drive is moved position-controlled to the specified target position. A positioning task can be stopped and continued at any position. When the target or stop position is reached, the drive stops position-controlled at this position.
It is controlled via the following interfaces:
- Digital inputs/outputs (DIO)
  - DI1 "Mov_{In}" [Logic, Pin 5]
  - DI2 "Mov_{Out}" [Logic, Pin 6]
- IO-Link process data (LK), ➔ 15.2.3 Process data
  - 0x0029.1 "$Move_{In}$"
  - 0x0029.2 "$Move_{Out}$"
  - 0x0029.5 "$Move_{Intermediate}$" (from firmware version v19.0.4.107_release)
- IO-Link system parameters (LK), ➔ 15.2.4 System parameters
  - 0x0002 ‘Execute "Move In"’, ‘Execute "Move Out"’ or ‘Execute "Move Intermediate"’

The following commands are available:
- $Start_{In}$ positioning task: start or continue "Mov_{In}" position-controlled travel to the "Lim_{In} (Ref)" end position
- $Start_{Out}$ positioning task: start or continue "Mov_{Out}" position-controlled travel to the "Lim_{Out}" end position
- $Start_{Imp}$ positioning task: start or continue "Mov_{Imp}" position-controlled travel to the "Pos_{Imp}" intermediate position (from firmware version v19.0.4.107_release)
- Stop task: stop travel

"Single point-to-point operation" sequence
– $Ctrl_P$: position-controlled travel
Simple point-to-point operation[1)]

Simple point-to-point operation with intermediate position (IO-Link only, from firmware version v19.0.4.107_release)


1)

Tab. 33: "Single point-to-point operation" sequence

10.3.3.2 Parameter

Value range correction for intermediate position

When saving the "End position Lim_{Out}" (0x0106.0), the "Intermediate position" setpoint value "Pos_{Imp}" (0x0108.0) is checked for value validity. If the > "End position Lim_{Out}" value is exceeded, the value is automatically set to the parameterised "End position Lim_{Out}" setpoint value.

Name	Description	HMI (menu)	IO-Link (Index. Subindex)
‘Speed In’	‘Speed In’ target velocity for the "Mov_{In}" travel	‘Speed In’	0x0100.0
‘Speed Out’	‘Speed Out’ target velocity for the "Mov_{Out}" travel	‘Speed Out’	0x0101.0
a+	Target acceleration for all motions	1)	1)
a–	Target deceleration for all motions	1)	1)
Lim_{In}	Position of the "In" end position2)	1)	1)
Lim_{Out}	Position of the "Out" end position3)	1)	0x0106.0
Pos_{Imp}	Position of the intermediate position3)	–	0x0108.0

1) unchangeable parameter
2) Position = "Ref" reference end position
3) "Ref" reference end position reference point

Tab. 34: Parameters for single point-to-point operation

10.3.3.3 Timing

Timing: travel to "Lim_{Out}/Lim_{In}" end position

The diagram shows the status data in DIO and IO-Link operation of the "Mov_{Out}/Mov_{In}" motion from the "$Start_{Out}$/$Start_{In}$" command to reaching the "Lim_{Out}/Lim_{In}" end position.

Activate positioning task $Start_{In}$

- DIO, digital inputs: DI1 "Mov_{In}" = 1 and DI2 "Mov_{Out}" = 0
- IO-Link, process data: 0x0029.1 = true, 0x0029.2 and 0x0029.5 = false
  IO-Link, system parameter: 0x0002, value = 0xC8 ‘Execute "Move In"’

Activating positioning task $Start_{Out}$

- DIO, digital inputs: DI2 "Mov_{Out}" = 1 and DI1 "Mov_{In}" = 0
- IO-Link, process data: 0x0029.2 = true, 0x0029.1 and 0x0029.5 = false
  IO-Link, system parameter: 0x0002, value = 0xC9 ‘Execute "Move Out"’

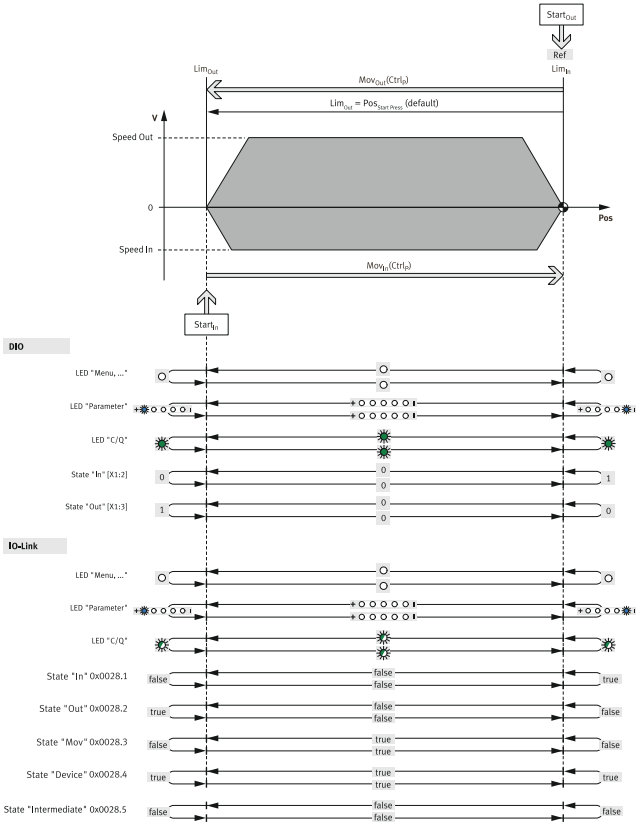


Fig. 22: Travel to "Lim_{Out}/ Lim_{In}" end positions

Timing: travel to "Pos_{Imp}" intermediate position (example towards "Lim_{Out}" end position)

The diagram shows the status data in IO-Link operation of the "Mov_{Imp}" motion from the "$Start_{Imp}$" command to reaching the "Pos_{Imp}" intermediate position.

Activating motion task $Start_{Imp}$

– IO-Link, process data: 0x0029.5 = true, 0x0029.1 and 0x0029.2 = false
  IO-Link, system parameter: 0x0002, value = 0xD0 ‘Execute "Move Intermediate"’

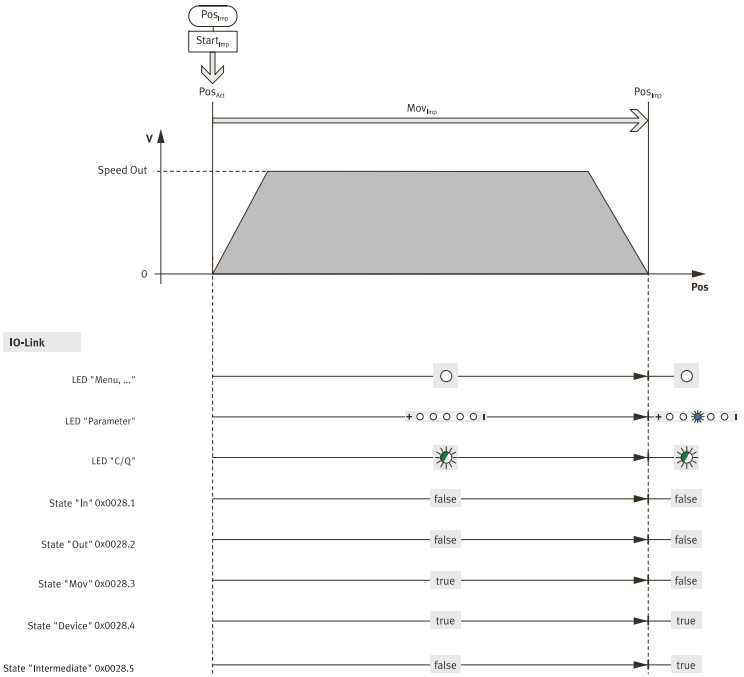


Fig. 23: Travel to "Pos_{Imp}" intermediate position

Timing: stop and continue motion (example "Mov_{Out}" motion)

The diagram shows the status data in DIO and IO-Link operation of the "Mov_{Out}" motion from the "Stop" and "$Start_{Out}$" commands to reaching the "Lim_{Out}" end position.

Stop task, activate stop

- DIO, digital inputs: DI1 "Mov_{In}" = 0 and DI2 "Mov_{Out}" = 0
- IO-Link, process data: 0x0029.1, 0x0029.2 and 0x0029.5 = false
  IO-Link, system parameter: 0x0002, value = 0xCA ‘Stop motion’

Activating positioning task $Start_{Out}$

- DIO, digital inputs: DI2 "Mov_{Out}" = 1 and DI1 "Mov_{In}" = 0
- IO-Link, process data: 0x0029.2 = true, 0x0029.1 and 0x0029.5 = false
  IO-Link, system parameter: 0x0002, value = 0xC9 ‘Execute "Move Out"’

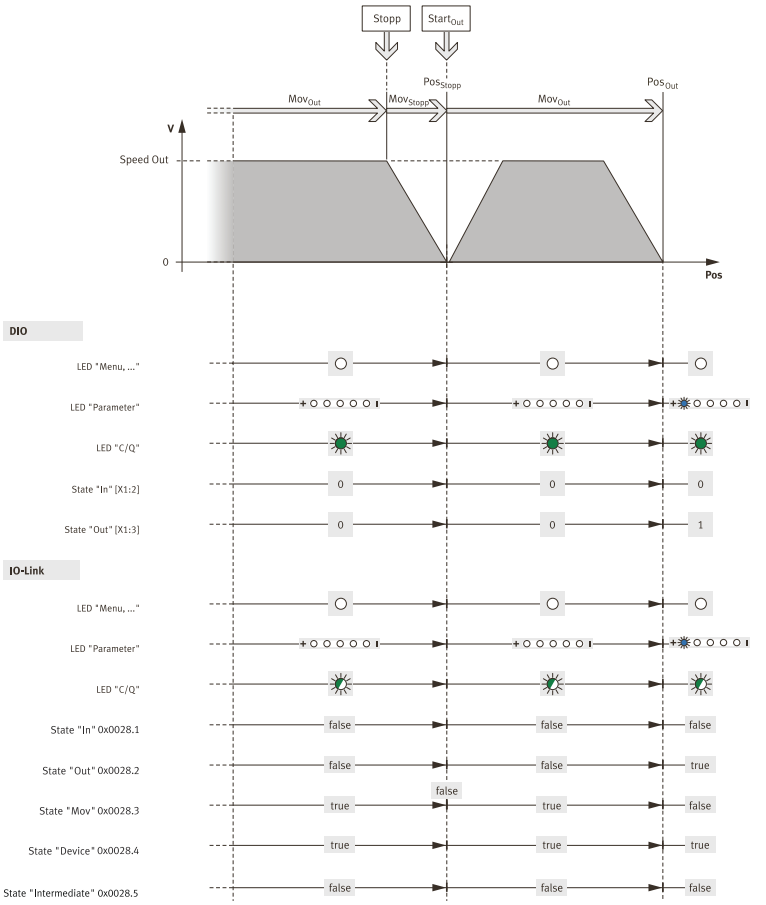


Fig. 24: Stop and continue travel

10.3.4 Point-to-point operation with press function

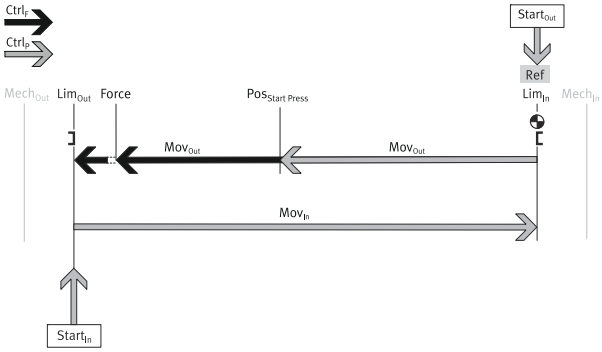
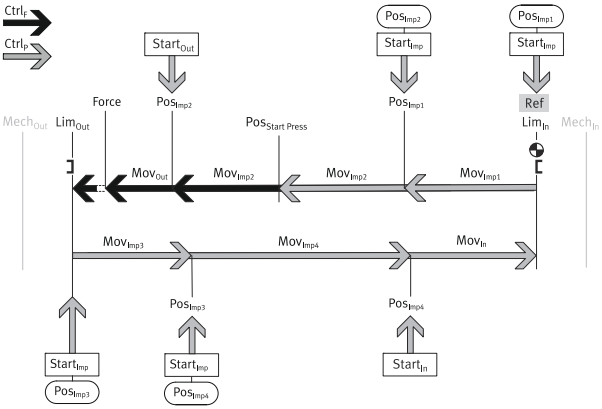
10.3.4.1 Function

In point-to-point operation with press function the drive can be traversed to the " Lim_{In}/Lim_{Out} end positions and Pos_{Imp} intermediate position" target positions or the force/torque setpoint value 'Force'. Multiple intermediate positions can be approached consecutively. The motion for the EMCS-ST is controlled by the "digital inputs/outputs (DIO)" or "IO-Link (LK)" at the [Logic] connection. The "In/Out end positions" positions and the "Mov_{In}/Mov_{Out}" directions of motion of the drive are defined by the "Ref" reference end position. The press function can be activated with the "Start Press Position $Pos_{Start\ Press}$ < Lim_{Out} end position" setpoint specification. The drive is moved position-controlled to the specified target position on activation of the $Move_{In}/Move_{Intermediate}$ positioning tasks. With the "$Move_{Out}$" positioning task the "$Pos_{Start\ Press}$" Start Press Position is approached position-controlled and then force-controlled until the force/torque setpoint value is reached or continued to the Lim_{Out} end position. A positioning task can be stopped and continued at any position. When the end position, intermediate or stop position is reached, the drive stops position-controlled at this position. When the force/torque setpoint value is reached, the drive stops force-controlled.
It is controlled via the following interfaces:
- Digital inputs/outputs (DIO)
  - DI1, "Mov_{In}" [Logic, Pin 5]
  - DI2, "Mov_{Out}" [Logic, Pin 6]
- IO-Link process data (LK), ➔ 15.2.3 Process data
  - 0x0029.1, "$Move_{In}$"
  - 0x0029.2, "$Move_{Out}$"
  - 0x0029.5, "$Move_{Intermediate}$" (from firmware version v19.0.4.107_release)
- IO-Link system parameters (LK), ➔ 15.2.4 System parameters
  - 0x0002 'Execute "Move In"' or 'Execute "Move Out"'

The following commands are available:
- $Start_{In}$: start or continue position-controlled travel "Mov_{In}" to "Lim_{In}(Ref)" end position
- $Start_{Out}$: start or continue position-controlled and force-controlled "Mov_{Out}" motion to the "Lim_{Out}" end position
- $Start_{Imp}$: start or continue "Mov_{Imp}" position-controlled travel to the "Pos_{Imp}" intermediate position (from firmware version v19.0.4.107_release)
- Stop task: stop travel

The diagrams show the movements in point-to-point operation
- Mov_{Out}: position-controlled movement $Ctrl_P$ ⇛ to the end position "Lim_{Out}"
- Mov_{In}: position-controlled movement $Ctrl_P$ ⇛ to the end position "Lim_{In}"
- Mov_{Imp}: position-controlled movement $Ctrl_P$ ⇛ to the intermediate position "Pos_{Imp}"
- Point-to-point operation with press function, from Start Press Position "$Pos_{Start\ Press}$"
  - Mov_{Out}: force-controlled movement $Ctrl_F$ ➔ until the parameterised force or torque setpoint value "Force" is reached or to the end position "Lim_{Out}"
  - Mov_{Imp}: force-controlled motion $Ctrl_F$ ➔ to the "Pos_{Imp}" intermediate position

Force is controlled and evaluated by closed-loop control of the motor current. A torque level or a linear force can be determined from the level of current measured depending on the mechanism of the drive. The target is set as a percentage of the rated motor current and may deviate from the actual force on the drive unit. If force levels are set low, the influence of friction in the system on the running behaviour and the actual force on the drive unit must also be taken into account.

"Point-to-point operation with press function" sequence
– $Ctrl_P$⇛: position-controlled travel – $Ctrl_F$➔: force-controlled travel
Point-to-point operation with press function

Point-to-point operation with press function and intermediate position (IO-Link only, from firmware version v19.0.4.107_release)


Tab. 35: "Point-to-point operation with press function" sequence

10.3.4.2 Parameter

Value range correction for intermediate position or Start Press Position
When saving the "End position Lim_{Out}" (0x0105.0), the "Pos_{Imp} (0x0108.0) and Start Press Position $Pos_{Start\ Press}$ intermediate position (0x0105.0)" setpoint values are checked for value validity. If the > "Lim_{Out} end position" value is exceeded, the values are automatically set to the parameterised "End position Lim_{Out}" setpoint value.

Name	Description	HMI (menu)	IO-Link (Index. Subindex)
'Speed In'	'Speed In' target velocity for the "Mov_{In}" travel	'Speed In'	0x0100.0
'Speed Out'	'Speed Out' target velocity for the "Mov_{Out}" travel	'Speed Out'	0x0101.0
'Speed Press'	'Speed Press' target velocity for the "Mov_{Out}" travel from the "$Pos_{Start\ Press}$" start press position	1)	)
'Force'	Target force/torque 'Force' for the "Mov_{Out}" travel from the "$Pos_{Start\ Press}$" start press position	'Force'	0x0102.0
a+	Target acceleration for all motions	)	)
a–	Target deceleration for all motions	)	)
Lim_{In}	Position of the "In" end position[2)]	)	)
Lim_{Out}	Position of the "Out" end position[3)]	'End Position Out'	0x0106.0
Pos_{Imp}	Position of the intermediate position[3)]	)	0x0108.0
$Pos_{Start\ Press}$	Position of the Start Press Position[3)]	'Start Press'	0x0105.0

1) unchangeable parameter
2) Position = "Ref" reference end position
3) "Ref" reference end position reference point

Tab. 36: Parameter for the point to point-to-point with press function

10.3.4.3 Timing

Timing: travel to 'Force' setpoint value or "Lim_{Out}/Lim_{In}" end position
The diagram shows the status data in DIO and IO-Link operation of the "Mov_{Out} with press function/ Mov_{In}" motion from the "$Start_{Out}$/$Start_{In}$" command to reaching the "Lim_{Out}/Lim_{In}" end position.

Activate positioning task $Start_{In}$
- DIO, digital inputs: DI1 "Mov_{In}" = 1 and DI2 "Mov_{Out}" = 0
- IO-Link, process data: 0x0029.1 = true, 0x0029.2 and 0x0029.5 = false
  IO-Link, system parameter: 0x0002, value = 0xC8 'Execute "Move In"'

Activating positioning task $Start_{Out}$

– DIO, digital inputs: DI2 "Mov_{Out}" = 1 and DI1 "Mov_{In}" = 0
– IO-Link, process data: 0x0029.2 = true, 0x0029.1 and 0x0029.5 = false
  IO-Link, system parameter: 0x0002, value = 0xC9 'Execute "Move Out"'

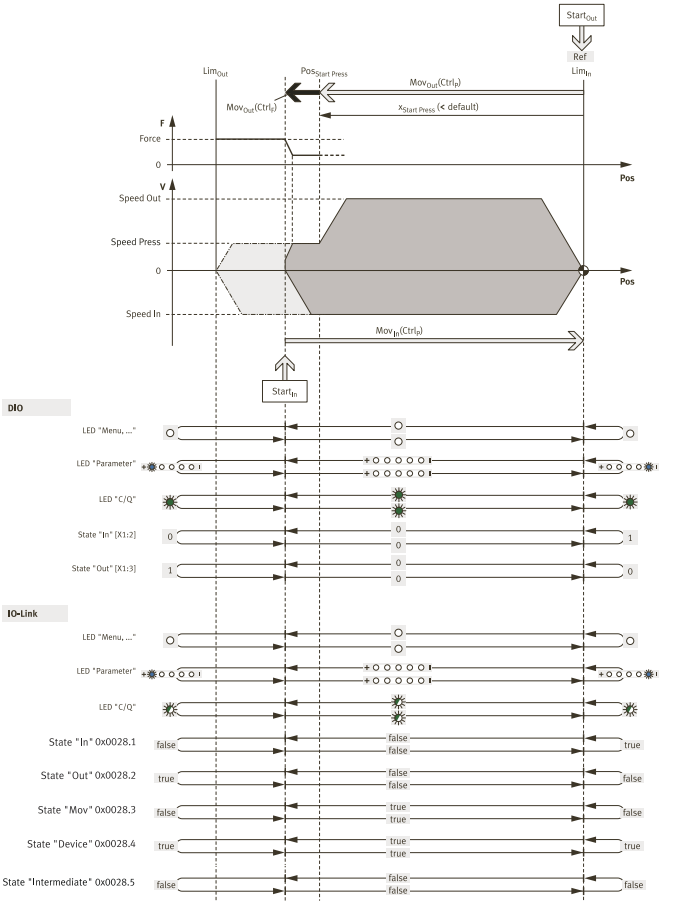


Fig. 25: Travel to "Force" setpoint value or "Lim_{Out}/Lim_{In}" end position

Timing: travel to "Pos_{Imp}" intermediate position (example towards "Lim_{Out}" end position)

The diagram shows the status data in IO-Link operation of the "Mov_{Imp}" motion from the "$Start_{Imp}$" command to reaching the "Pos_{Imp}" intermediate position in the position or force-controlled range.

Activating motion task $Start_{Imp}$

– IO-Link, process data: 0x0029.5 = true, 0x0029.1 and 0x0029.2 = false
  IO-Link, system parameter: 0x0002, value = 0xD0 'Execute "Move Intermediate"'

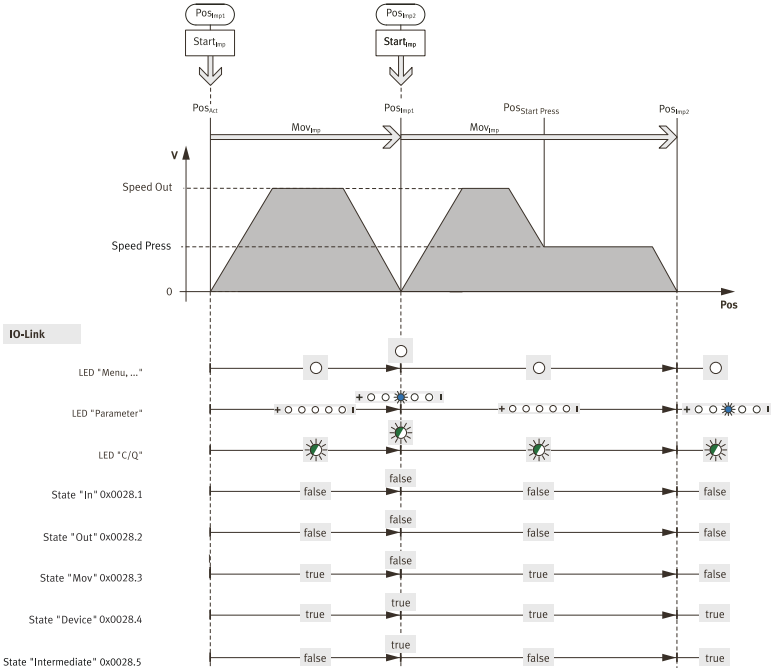


Fig. 26: Travel to "Pos_{Imp}" intermediate position

Timing: stop and continue motion (example "Mov_{Out}" motion)

The diagram shows the status data in DIO and IO-Link operation of the "Mov_{Out} with press function" motion from the "Stop" and "$Start_{Out}$ until reaching the end position" commands to reaching the "Lim_{Out}" end position.

Stop task, activate stop

- DIO, digital inputs: DI1 "Mov_{In}" = 0 and DI2 "Mov_{Out}" = 0
- IO-Link, process data: 0x0029.1, 0x0029.2 and 0x0029.5 = false
  IO-Link, system parameter: 0x0002, value = 0xCA ‘Stop motion’

Activating positioning task $Start_{Out}$

- DIO, digital inputs: DI2 "Mov_{Out}" = 1 and DI1 "Mov_{In}" = 0
- IO-Link, process data: 0x0029.2 = true, 0x0029.1 and 0x0029.5 = false
  IO-Link, system parameter: 0x0002, value = 0xC9 ‘Execute "Move Out"’

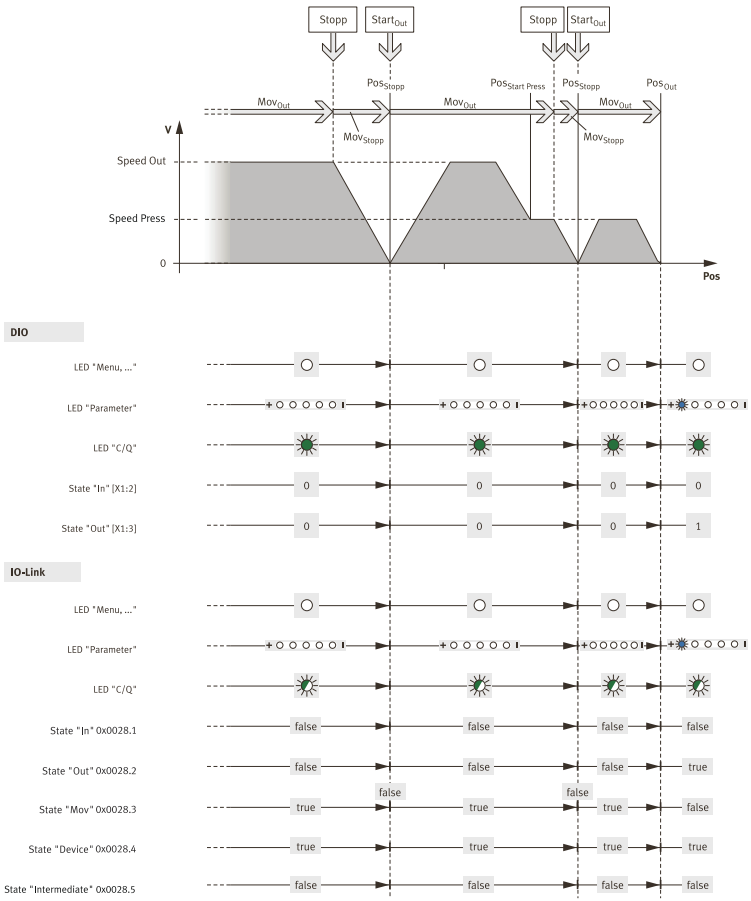


Fig. 27: Stop and continue travel

10.3.5 Manual operation (demo)

10.3.5.1 Function

In manual operation the drive can be moved to the "Lim_{In}/Lim_{Out} end positions" target positions. Manual operation of the EMCS-ST is controlled by the pushbutton actuators of the control elements (HMI). The "In/Out end positions" positions and the "Mov_{In}/Mov_{Out}" directions of motion of the drive are defined by the "Ref" reference end position. Pressing an arrow pushbutton actuator moves the drive to the specified end position. A positioning task can be stopped at any position by pressing the opposite arrow pushbutton actuator. When the target position or stop position is reached, the drive stops position-controlled at this position.

The following commands are available:

- Start ➔ positioning task: start or continue "Mov_{In}" position-controlled travel to the "Lim_{In} (Ref)" end position
- Start ← positioning task: start or continue "Mov_{Out}" position-controlled travel to the "Lim_{Out}" end position
- Stop task: stop position-controlled travel

Manual operation supports the following tasks:

- Drive free running, e.g. after a system malfunction
- Manual procedure for checking settings and drive behaviour

10.3.5.2 Parameter

Name	Description	HMI (menu)	IO-Link (Index. Subindex)
'Speed In'	'Speed In' target velocity for the "Mov_{In}" travel	'Speed In'	0x0100.0
'Speed Out'	'Speed Out' target velocity for the "Mov_{Out}" travel	'Speed Out'	0x0101.0
a+	Target acceleration for all motions	1)	–
a–	Target deceleration for all motions	1)	–
Lim_{In}	Position of the "Lim_{In}" end position	1)	–
Lim_{Out}	Position of the "Lim_{Out}" end position	1)	0x0106.0

1) unchangeable parameter

Tab. 37: Parameters for manual operation (demo)

10.3.5.3 Timing

The diagram shows the status data in DIO and IO-Link operation of the "Mov_{Out}/Mov_{In}" demo runs from the "Start←/Start➔" command to reaching the "Lim_{Out}/Lim_{In}" end position.

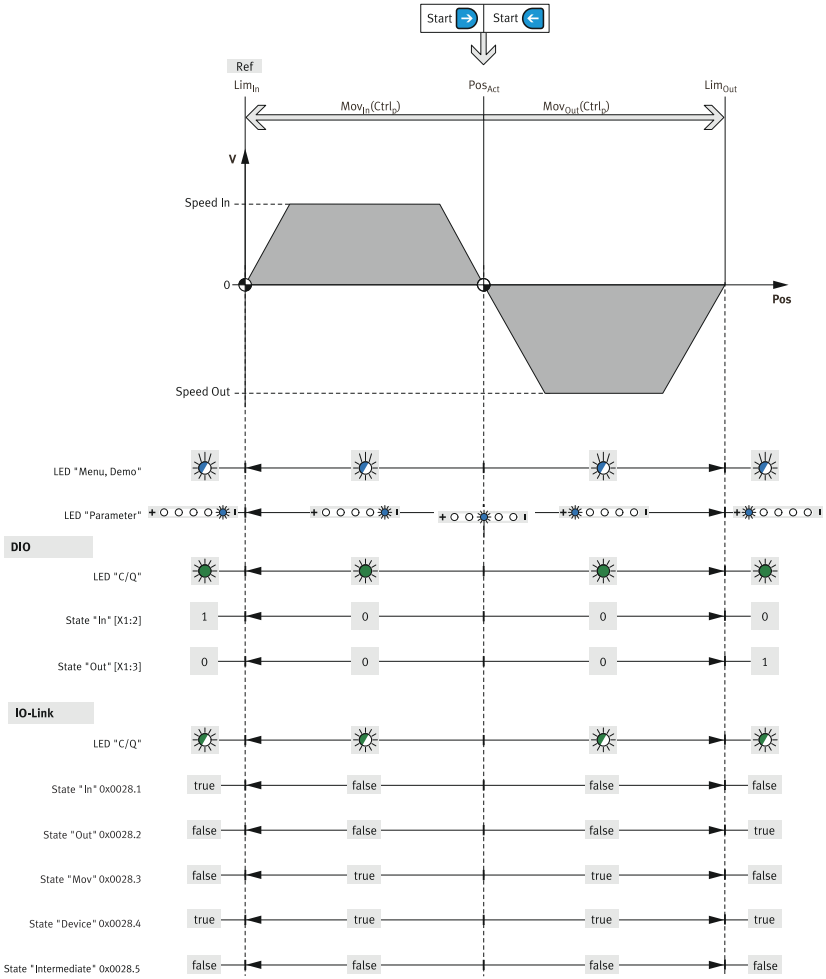


Fig. 28: Demo run

11 Maintenance and care

If used as intended, the product is maintenance-free.
Clean the product with a clean and soft cloth.

12 Diagnostics and malfunctions

12.1 Diagnostics via LED displays

12.1.1 C/Q LED (communication status and device status)

LED	Meaning
 off	– No logic voltage – Control interface "digital inputs/outputs (DIO) or IO-Link (LK) [Logic]" not active
 green light	– Control interface "digital inputs/outputs (DIO) [Logic]" active, drive ready for DIO operation (communication between controller and EMCS-ST possible)
 flashing green	– Control interface "IO-Link (LK) [Logic]" active (communication between IO-Link master and EMCS-ST possible)
 yellow light	– Warning active or system not referenced (The warning can be read out via the IO-Link interface)
 red light	– Error active (Errors are displayed via the LED displays menu and parameters or can be read out via the IO-Link interface)

Tab. 38: C/Q LED (communication status and device status)

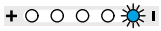
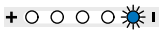
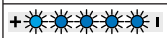
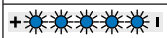
12.1.2 "Menu" LED display

In conjunction with fault diagnostics, the "Menu" LED display is also used to display error codes.

Function	LED	Meaning
'Speed Out' 'Speed In' 'Force'	 blue light	– 'Speed Out', 'Speed In' or 'Force' menu selected
	 blue flashing	– 'Speed Out', 'Speed In' or 'Force' menu activated – Setpoint value can be parameterised
'Reference'	 blue light	– 'Reference' menu selected – Drive system referenced – Homing stopped
	 blue flashing	– 'Reference' menu activated – Reference end position configurable – Start homing with end position determination
'Start Press'	 blue light	– 'Start Press' menu selected
	 blue flashing	– 'Start Press' menu activated – Start 'Start Press' travel
'Demo'	 blue light	– 'Demo' menu selected
	 blue flashing	– 'Demo' menu activated – Start 'Demo' travel

Tab. 39: "Menu" LED display

12.1.3 LED display "Parameter"

Function	LEDs	Meaning
‘Speed Out’ ‘Speed In’ ‘Force’[1]		10% of maximum value
		20% of maximum value
	...	...
		90% of maximum value
		100% of maximum value

1) Force is controlled and evaluated by closed-loop control of the motor current. A torque level or a linear force can be determined from the level of current measured depending on the mechanism of the drive. The target is set as a percentage of the rated motor current and may deviate from the actual force on the drive unit. If force levels are set low, the influence of friction in the system on the running behaviour and the actual force on the drive unit must also be taken into account.

Tab. 40: LED display "Parameter"

12.2 Diagnostic messages

Diagnostic messages are classified as information, warnings or errors. If an error occurs, operation is interrupted and the power stage is switched off. Warnings and errors remain active until the cause of the event has been corrected. After the cause has been eliminated, warnings are automatically deleted from the diagnostic memory with the next motion task. If errors occur, the error must be acknowledged. After acknowledgement of the error, the power stage is activated with the application of the next travel command or via system parameter 0x0002 ‘System-Commands’, value 0xCC ‘Enable power stage’.

12.2.1 Acknowledge error

With error acknowledgment, active error messages are deleted from the diagnostic memory if the cause of the error was remedied before acknowledgment.
Errors can be acknowledged via the following interfaces:

Error acknowledgement	operation		
	HMI	DIO	IO-Link
Restart: – Logic voltage L_+, Power OFF/ON [Logic, Pin 1]	X	X	X
HMI (from firmware version v19.0.4.107_release): – Press and hold Edit for 3 s	X	–	–
DIO, digital inputs (from firmware version v19.0.4.107_release): – DI1 "Mov_{In}" = 1 [Logic, Pin 5] DI2 "Mov_{Out}" = 1 [Logic, Pin 6]	–	X	–

Error acknowledgement	**operation**		
	HMI	DIO	IO-Link
IO-Link, device data: – 0x0107.0 ‘Quit Error’ = true	–	–	X
IO-Link, process data: – 0x0029.3 ‘Quit Error’ = true – 0x0029.1 "Mov_{In}" = true 0x0029.2 "Mov_{Out}" = true 0x0029.5 "$Mov_{Intermediate}$" = any (from FW version v19.0.4.107_release)	–	–	X

Tab. 41: Overview of error acknowledgment

12.2.2 Diagnostic messages and fault clearance

"Information, Warnings and Errors" diagnostic messages are displayed by the C/Q LED and menu and parameters LED displays.

Errors are reported to the controller as follows:

– DIO operation: output signals DO1 and DO2 = 1 [Logic, Pin 2/3]

– IO-Link operation: 0x0028.1 ‘ProcessDataInput State "In"’ and 0x0028.2 ‘State "Out"’ = true

The error that occurred first is always displayed at the LED displays on the HMI.

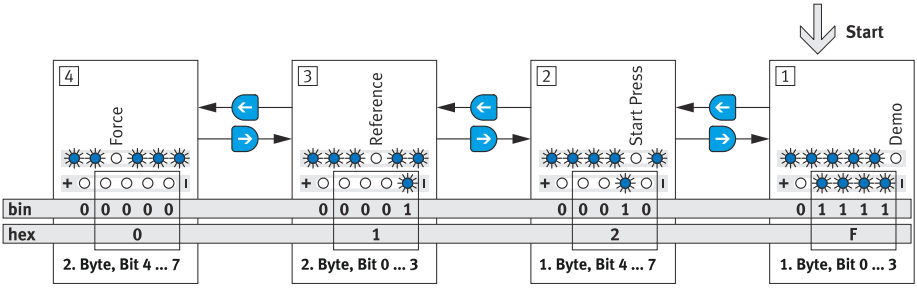
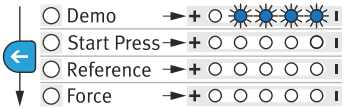
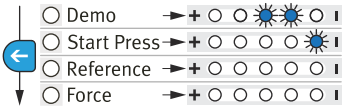
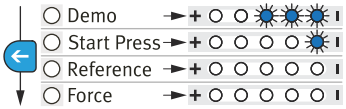
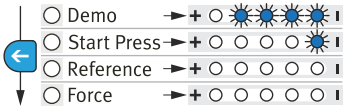
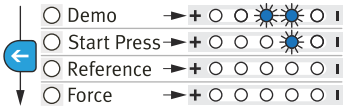
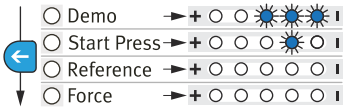
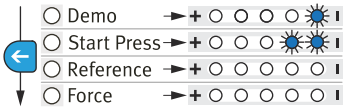
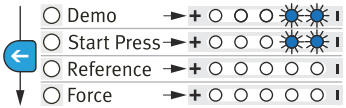
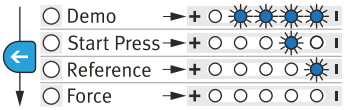


Fig. 29: Display of diagnostic messages (example)

Error code hex (dec)	Description	LED C/Q	LED indicators Menu	 Parameters	Event code (IO-Link)
Information[1]					
–	Waiting for motion task to initialise the reference end position	 yellow light	–		0x8CA0
–	Motion to initialise the reference end position is executed				0x8CA1
Warning					
–	Invalid value for "Start Press" position[2]	–	–		0x8CA2
–	Invalid value for Lim_{out}[2] end position	–			0x8CA3
–	I^2t monitoring power stage warning[2]	 yellow on[2]			0x8CA4
–	Warning threshold: temperature in device too high[2]				0x4210
–	Warning threshold: temperature in device too low[2]				0x4220
Error					
–	Common device error or unlisted errors Remedy – Contact Festo	 red light	…		0x1000
0x000F (15)	I^2t output stage monitor error limit Remedy –				0x1805
0x0016 (22)	24 V logic supply undervoltage[3] Remedy – Check logic voltage supply				0x1804

Error code hex (dec)	Description	LED C/Q	LED indicators Menu	Parameters	Event code (IO-Link)
0x0017 (23)	24 V logic supply overvoltage Remedy – Check logic voltage supply	 red light			0x1803
0x001F (31)	Undervoltage in intermediate circuit Remedy – Check the load voltage supply – Check power socket for contamination				0x1806
0x0026 (38)	24 V load supply under-voltage Remedy – Check the load voltage supply – Check power socket for contamination				0x1802
0x0027 (39)	24 V load supply overvoltage Remedy – Check the load voltage supply				0x1801
0x0031 (49)	Device undertemperature Remedy – Check ambient conditions				0x4000
0x0033 (51)	Device overtemperature Remedy – Check ambient conditions – Check installation conditions				

Error code hex (dec)	Description	LED C/Q	LED indicators Menu	 Parameters	Event code (IO-Link)
0x012F (303)	IO-Link connection interrupted Remedy – Check power supply – Check IO-Link master – When using the IO-Link Master Beckhoff EL6224: deactivate data storage mechanism "disable"	red light			–

1) Information is not shown in the diagnostics data ➔ IO-Link, device data.
2) only with IO-Link operation
3) This error can only be acknowledged by a restart.

Tab. 42: "Information, Warnings and Errors" diagnostic messages

12.3 Repair

Repair or maintenance of the product is not permissible.

– Replace with an identical product ➔ www.festo.com/spareparts.

13 Replacement

The following components can be replaced ➔ www.festo.com/spareparts in the Simplified Motion Series drive systems.

Drive systems Simplified Motion Series	Spare part		
	Drive system	Drive	Motors with integrated controller
Mini slide unit EGSS-BS	–	Mini slide EGSC	Integrated drive EMCS-ST
Toothed belt axis unit ELGE-TB	–	Toothed belt axis ELGR-TB	Integrated drive EMCS-ST
Ball screw axis unit ELGS-BS	–	Ball screw axis ELGC-BS	Integrated drive EMCS-ST
Toothed belt axis unit ELGS-TB	–	Toothed belt axis ELGC-TB	Integrated drive EMCS-ST
Electric cylinder unit EPCE-TB	Electric cylinder unit EPCE-TB	–	–

Drive systems Simplified Motion Series	Spare part		
	Drive system	Drive	Motors with integrated controller
Electric cylinder unit EPCS-BS	–	Electric cylinder EPCC	Integrated drive EMCS-ST
Rotary drive unit ERMS	Rotary drive unit ERMS	–	–

Tab. 43: Overview of spare parts

Replacing drive system EGSS-BS, ELGE-TB, ELGS-BS, ELGS-TB, EPCE-TB, EPCS-BS or ERMS
Additional information ➔ Instruction manual of the drive system

Replacing integrated drive EMCS-YE-ST/EMCS-YY-ST
1. Save the application parameters to the IO-Link master ➔ 10.2.3 Data backup ‘Data Storage’
2. Demount the defective integrated drive EMCS ➔ 14 Demounting
3. Mount the new integrated drive EMCS ➔ 1.1 Applicable documents
4. Connect the integrated drive EMCS ➔ 8 Installation
5. Commission the drive system ➔ 9 Commissioning
6. Update the parameter set (only required for EMCS-YY-ST) ➔ 10.2.2 Parameter set
7. Update the firmware (optional) ➔ 10.2.1 Firmware
8. Download the application parameters from the IO-Link master ➔ 10.2.3 Data backup ‘Data Storage’

Replacing drive EGSC, ELGC-BS, ELGC-TB, ELGR-TB or EPCC-BS
1. Save the application parameters to the IO-Link master ➔ 10.2.3 Data backup ‘Data Storage’
2. Demount the drive system ➔ 14 Demounting
3. Remove the defective drive ➔ 14 Demounting
4. Mount the new drive ➔ 1.1 Applicable documents
5. Mount the drive system ➔ 1.1 Applicable documents
6. Connect the integrated drive EMCS ➔ 8 Installation
7. Commission the drive system ➔ 9 Commissioning
8. Update the parameter set (only required for EMCS-YY-ST) ➔ 10.2.2 Parameter set
9. Update the firmware (optional) ➔ 10.2.1 Firmware
10. Download and install the application software of the IO-Link master ➔ 10.2.3 Data backup ‘Data Storage’

14 Demounting

⚠ WARNING

Unexpected movement of components.
Injury due to impacts or crushing.
- Before working on the product, switch off the control and secure it to prevent it from being switched back on accidentally.

⚠ WARNING

Risk of Injury due to Unexpected Movement of Components

For vertical or slanted mounting position: when power is off, moving parts can travel or fall uncontrolled into the lower end position.

- Bring moving parts of the product into a safe end position or secure them against falling.

Demounting the integrated drive EMCS

1. Allow the product to cool down to room temperature.
2. Disconnect electrical installations on the EMCS.
3. Remove EMCS from the mounting kit.
4. Observe transport information ➔ 6 Transport.

Demounting the drive

1. Allow the product to cool down to room temperature.
2. Disconnect electrical installations.
3. Remove the mounted attachment component.
4. Remove the attached accessories.
5. Remove the integrated drive and mounting kit.
6. Remove the mounting attachments.
7. Observe transport information ➔ 6 Transport.

Demounting drive system ➔ Instruction manual for drive system ➔ www.festo.com/sp.

15 IO-Link

15.1 Device description file IODD

ⓘ

The boot time of the integrated drive EMCS-ST is 7 s (deviation from the IO-Link specification)

Depending on the drive system, device description files (IODD files) are available for configuring the integrated drive EMCS-ST in IO-Link operation.

Drive system		IODD file name
Linear		
EGSS-BS	Mini slide unit	Festo-EGSS-BS-...-IODD1.1.xml
ELGE-TB	Toothed belt axis unit	Festo-ELGE-TB-...-IODD1.1.xml
ELGS-BS	Ball screw axis unit	Festo-ELGS-BS-...-IODD1.1.xml
ELGS-TB	Toothed belt axis unit	Festo-ELGS-TB-...-IODD1.1.xml
EPCE-TB	Electric cylinder unit	Festo-EPCE-TB-...-IODD1.1.xml
EPCS-BS	Electric cylinder unit	Festo-EPCS-BS-...-IODD1.1.xml

Drive system		IODD file name
Rotary		
ERMS	Rotary drive unit	Festo-ERMS-...-IODD1.1.xml

Tab. 44: Device description file IODD

The current device description files are available on the Festo Support Portal ➔ www.festo.com/sp.

15.2 IO-Link parameters

The following parameter groups are available for configuration and operation of the integrated drive in an IO-Link network:
- Identification parameters: IDs, version numbers, ... ➔ 15.2.1 Identification parameters
- Device data: setpoint and actual values, limit values, ... ➔ 15.2.2 Device data
- Process data: commands, status information, ... ➔ 15.2.3 Process data
- System parameters: control functions for application software, ➔ 15.2.4 System parameters
- Save parameters, control file handling (from firmware version v19.0.4.107_release) ➔ 15.2.2 Device data
- Diagnostic data: device status,... ➔ 15.2.2 Device data

15.2.1 Identification parameters

The identification parameters contain all manufacturer-specific device data (e.g. IDs, version numbers) in order to identify the integrated EMCS-ST drive in the IO-Link network. The identification data are exchanged acyclically between the IO-Link master and the EMCS-ST on request by the IO-Link Master.

Index. Subindex	Name	Description	Data type (length)	User access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
0x0000.08 (0.8)	'VendorID1'	ID of the manufacturer, 4-digit hex ID (dec) – 0x014D (333)	– (1 byte, MSB)	R	R	R
0x0000.09 (0.9)	'VendorID2'		– (1 byte, LSB)	R	R	R

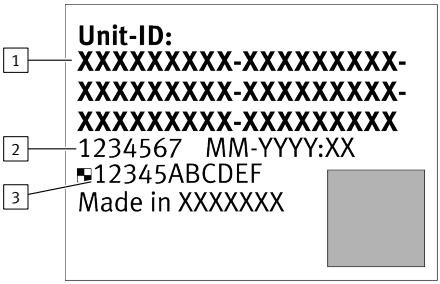
Index. Subindex	Name	Description	Data type (length)	User access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
0x0000.0A (0.10)	‘DeviceID1’	Device ID of the drive system, 6-digit hex ID (dec) – 0x000258 (600): EMCS-(YY)-ST (spare part) – 0x000259 (601): ELGS-TB – 0x00025A (602): ELGS-BS – 0x00025B (603): EGSS-BS – 0x00025C (604): ELGE-TB – 0x00025D (605): ERMS – 0x00025E (606): EPCS-BS – 0x00025F (607): EPCE-TB	– (1 byte, MSB)	R	R	R
0x0000.0B (0.11)	‘DeviceID2’		– (1 bytes)	R	R	R
0x0000.0C (0.12)	‘DeviceID3’		– (1 byte, LSB)	R	R	R
0x0010.0 (16.0)	‘Vendor Name’	Name of the manufacturer, 17-character code – Festo	String (17 bytes)	R	R	R
0x0011.0 (17.0)	‘Vendor Text’	URL of the manufacturer, 20-character code – http://www.festo.com	String (20 bytes)	R	R	R
0x0012.0 (18.0)	‘Product Name’	Complete type code of the drive unit, product-dependent character code – EGSS-BS -... – ELGS-BS-... – ELGS-TB-... – ELGE-TB-... – EPCE-TB-... – EPCS-BS -... – ERMS-... ➔ Identification data on the product labelling of the drive unit	String (≤64 bytes)	R	R	R
0x0013.0 (19.0)	‘Product ID’	Part number of the drive unit, product-dependent 7-digit numeric code ➔ Identification data on the product labelling of the drive unit	String (≤64 bytes)	R	R	R
0x2101.0 (8449.0)	‘Part Number’					

Index. Subindex	Name	Description	Data type (length)	User access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
0x0014.0 (20.0)	'Product Text'	Group name of the Simplified Motion Series drive unit, product-dependent character code	String (≤64 bytes)	R	R	R
0x0015.0 (21.0)	'Serial Number'	Product key for the drive unit, product-dependent 11-character code ➔ Identification data on the product labelling of the drive unit	String (11 bit)	R	R	R
0x0016.0 (22.0)	'Hardware Revision'	Hardware version of the EMCS-ST, product-dependent character code – e.g. REV05	String (≤64 bytes)	R	R	R
0x0017.0 (23.0)	'Firmware Revision'	Firmware version of the EMCS-ST, product-dependent character code – e.g. V16.0.17.87_release	String (≤64 bytes)	R	R	R
0x43BE.0 (17342.0)	'Hardware Identification Key'	Hardware identification key of the drive unit, product-dependent character code – e.g. BOOTLOAD_FW	String (≤64 bytes)	R	R	R
0x0018.0 (24.0)	'Application Specific Tag'	Text field for application information, max. 32 characters	String (≤32 bytes)	R/W	R/W	R/W
0x0019.0 (25.0)	'Function Tag'	Text field for function information, max 32 characters	String (≤32 bytes)	R/W	R/W	R/W
0x001A.0 (26.0)	'Location Tag'	Text field for location information, max. 32 characters	String (≤32 bytes)	R/W	R/W	R/W

1) R/W = read and write, R = read only, W = write only

Tab. 45: Identification parameters

Identification data on the product labelling of the drive unit



1 Type code (‘Product Name’)

2 Part number (‘Product ID’, ‘Part Number’)

3 Product Key (‘Serial Number’)

Fig. 30: Product labelling of drive unit

15.2.2 Device data

The device parameters contain all application data (e.g. setpoints and actual values, limit values, ...) for operating the drive system. Changes to the device data are exchanged acyclically between the IO-Link master and EMCS-ST.

Automatic saving of device data

If automatic storage is activated (0x0109.0 = true, default), parameter changes in the device data (= data storage parameters ➔ "Integrated drive EMCS" instruction manual ➔ www.festo.com/sp) are made automatically and permanently saved in the flash memory. Exceeding the maximum permissible 100,000 write cycles results in irreparable damage to the flash memory and the device, e.g. when using the device for positioning tasks via IO-Link.

If automatic saving is deactivated (0x0109.0 = false), parameter changes are only temporarily stored in the RAM. The RAM permits an unlimited number of parameter changes, e.g. for positioning tasks via IO-Link.

Index. Subindex	Name	Description	Data type (length)	Access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
Control data (master ➔ device)						
0x000C.4 (12.4)	'Device access lock'	Controls access to the display and operating components (HMI) – true: HMI access blocked – false: HMI access enabled	BooleanT (1 bytes)	–	R/W	R/W
0x0100.0 (256.0)	'Speed "In"'	10-stage speed specification from the maximum value for the "Mov_{In}" motion to the reference end position "Ref"/end position "Lim_{In}" – 1 = 10% (default) ... 10 = 100% ➔ Instruction manual for the drive system, technical data	UInteger8 (1 bytes)	–	R/W	R/W
0x0101.0 (257.0)	'Speed "Out"'	10-stage speed specification from the maximum value for the "Mov_{Out}" motion to the end position "Lim_{Out}" – 1 = 10% (default) ... 10 = 100% ➔ Instruction manual for the drive system, technical data	UInteger8 (1 bytes)	–	R/W	R/W
0x0102.0 (258.0)	'Force'[2]	10-step force/torque specification for the force-controlled "Mov_{Out}" motion from the "$Pos_{Start\ Press}$" position to the "Lim_{Out}" end position – 1 = 10% (default) ... 10 = 100% ➔ Instruction manual for the drive system, technical data	UInteger8 (1 bytes)	–	R/W	R/W

Index. Subindex	Name	Description	Data type (length)	Access[1)] U = User M = Maintenance personnel S = Specialist		
				U	M	S
0x0103.0 (259.0)	‘Reference’	Position of the reference end position "Ref" after homing has been completed Linear drive systems – true: facing away from motor – false: facing motor Rotary drive systems (ERMS: view to the rotating plate) – true: right – false: left	BooleanT (1 bytes)	–	R/W	R/W
0x0104.0 (260.0)	‘Execute "Reference" Movement’	Command for executing the homing with end position detection (detection of the mechanical end positions) – true: start homing – false: do not start homing	BooleanT (1 bytes)	–	W	W
0x0105.0 (261.0)	‘Position "Start Press"’	Stroke or angle of rotation distance from the "Start Press" position to the reference end position "Ref" (the drive changes from the "$Pos_{Start\ Press}$" position to the force-controlled movement) Linear drive systems – Length specification [mm] x 0.01 Rotary drive systems – Angle specification [°] x 0.1	Float32T (4 bytes)	–	R/W	R/W

Index. Subindex	Name	Description	Data type (length)	Access[1)] U = User M = Maintenance personnel S = Specialist		
				U	M	S
0x0106.0 (262.0)	‘End Position "Out"’	Stroke or rotation angle distance of the "Lim_{Out}" end position to the reference end position "Ref" (the drive stops at the "Lim_{Out}" end position and waits for the next motion command) Linear drive systems – Length specification [mm] x 0.01 Rotary drive systems – Angle specification [°] x 0.1	Float32T (4 bytes)	–	R/W	R/W
0x0107.0 (263.0)	‘Quit Error’	Command for acknowledging errors – true: start error acknowledgement – false: do not start error acknowledgement –	BooleanT (1 bytes)	–	W	W
0x0108.0 (264.0)	‘Intermediate Position’	Stroke or rotation angle distance of the intermediate position "Pos_{Imp}" to the reference end position "Ref" (the drive stops in the intermediate position "Pos_{Imp}" and waits for the next motion command) (from firmware version v19.0.4.107_release) Linear drive systems – Length specification [mm] x 0.01 Rotary drive systems – Angle specification [°] x 0.1	Float32T (4 bytes)	–	R/W	R/W

Index. Subindex	Name	Description	Data type (length)	Access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
Status data (device ➔ master)						
0x0120.0 (288.0)	'Current position'	Stroke or rotation angle distance of the current position to the reference end position "Ref" Linear drive systems – Length value [mm] x 0.01 Rotary drive systems – Angle value [°] x 0.1	Integer32 (4 bytes)	R	R	R
0x0121.0 (289.0)	'Current speed'	Current velocity or rotational speed of the drive Linear drive systems – Velocity value [mm/s] x 0.01 Rotary drive systems – Rotational speed [rpm] x 1	Integer32 (4 bytes)	R	R	R
0x0122.0 (290.0)	'Current force'[2]	Current force/current torque with press function Linear drive systems – Force value [N] x 1 Rotary drive systems – Torque value [Nm] x 0.1	Integer32 (4 bytes)	R	R	R
0x0123.0 (291.0)	'Current temperature'	Current temperature of the power stage – Temperature [°C] x 1	Integer16 (2 bytes)	R	R	R
0x0124.0 (292.0)	'Current electric current'	Current consumption at the motor – Current value [A] x 0.1	Integer32 (4 bytes)	R	R	R
0x0125.0 (293.0)	'Current electric voltage'	Current DC link voltage – Voltage [V DC] x 0.1	Integer32 (4 bytes)	R	R	R
0x0126.0 (294.0)	'Number of cycles total'[3]	Number (dec) of completed cycles of the drive unit since delivery	UInteger32 (4 bytes)	R	R	R

Index. Subindex	Name	Description	Data type (length)	Access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
0x0127.0 (295.0)	'Number of cycles since reset'[3]	Number (dec) of completed cycles of the drive unit since the last reset –	UInteger32 (4 bytes)	R	R	R
0x0128.0 (296.0)	'Mileage total'[3]	Mileage of the drive unit since delivery Linear drive systems – Length value [km] x 0.000001 Rotary drive systems – Rotation value [r] x 0.001	UInteger32 (4 bytes)	R	R	R
0x0129.0 (297.0)	'Mileage since reset'[3]	Mileage of the drive unit since the last reset Linear drive systems – Length value [km] x 0.000001 Rotary drive systems – Rotation value [r] x 0.001	UInteger32 (4 bytes)	R	R	R
0x012A.0 (298.0)	'Reset cycle & mileage'	Reset cycle and mileage counter – true: reset counter – false: do not reset counter	BooleanT (1 bytes)	W	W	W

Index. Subindex	Name	Description	Data type (length)	Access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
Saving parameters (from firmware version v19.0.4.107_release)						
0x0109.0 (265.0)	'Auto Store Active'	Control command for activating automatic and permanent saving of parameters in the flash memory ➔ Tab. 25 'Data Storage' parameter – true: automatic saving activated (default) – false: automatic saving deactivated. Saving can be controlled via the parameter 0x010B.0 Store parameters.	BooleanT (1 bytes)	–	R/W	R/W
0x010A.0 (266.0)	'Number Of Storage Operations'[4]	Information about the number of permanent storage processes in the flash memory	UInteger32 (4 bytes)	–	R	R
0x010B.0 (267.0)	'Store parameters'	Control command for permanent saving of parameters in the flash memory ➔ Tab. 25 'Data Storage' parameter – true: save parameters – false: parameters are temporarily saved in RAM (default)	BooleanT (1 bytes)	–	R/W	R/W

Index. Subindex	Name	Description	Data type (length)	Access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
File handling commands (from firmware version v19.0.4.107_release)						
0x0x3000.0 (12288.0)	'Enable File Handling'	Control command for activating file handling, e.g. firmware update – 0: file handling deactivated (default) – 8782: file handling activated – ...: reserved	UInteger16 (2 bytes)	–	R/W	R/W
0x0x3001.0 (12289.0)	'Execute File Handling'	Control command for executing file handling – 0: file handling deactivated (default) – 5: overwrite factory settings – 272: execute file handling, e.g. firmware update – ...: reserved	UInteger16 (2 bytes)	–	R/W	R/W
Diagnostic data (device ➔ master)						
0x0020 (32.0)	'Error Count'	Error counter reading since last Power ON or Reset	UInteger16 (2 bytes)	R	R	R
0x0024.0 (36.0)	'Device Status'	Information on the device status – 0: device works without errors – 1: maintenance required – 2: outside the specification – 3: functional check – 4: failure – 5 ... 255: reserved	UInteger8 (1 bytes)	R	R	R

Index. Subindex	Name	Description	Data type (length)	Access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
0x0025.0 (37.0)	'Detailed Device Status'	Information on current pending error or warning messages (up to 6 messages) Structure of messages: – Byte 1: EventQualifier – Byte 2 and 3: EventCode ➔ Tab. 42 "Information, Warnings and Errors" diagnostic messages If no warning or error message is present: bytes 1... 3 = 0x00	array (3 bytes x n)	R	R	R
0x0130.0 (304.0)	'Error code'	Display of the error code in the following formats (from firmware version v19.0.4.107_release) – 0x0000 – 0xFFFF: 4-digit hexadecimal value (hex) – 0 – 65635: 0 – 5-digit decimal value (dec) – 0_b – 1111 1111 1111 1111$_b$: 16-digit binary value (bin)	UInteger16 (2 bytes)	R	R	R

1) R/W = read and write, R = read only, W = write only
2) Force is controlled and evaluated by closed-loop control of the motor current. A torque level or a linear force can be determined from the level of current measured depending on the mechanism of the drive. The target is set as a percentage of the rated motor current and may deviate from the actual force on the drive unit. If force levels are set low, the influence of friction in the system on the running behaviour and the actual force on the drive unit must also be taken into account.
3) This value is transferred to the memory every 15 minutes. After a restart, the value corresponds to the status of the last save process. Changes to the cycle counter that have started since the last saving process are lost with on restart or power off.
4) This value is transferred to the memory every 15 minutes. After a restart, the value corresponds to the status of the last save process. Changes that have started since the last saving process are lost with on restart or power off.

Tab. 46: Device data

15.2.3 Process data

The process data contain all control and status data (e.g. commands, status information) required to operate the drive system. The process data are cyclically exchanged between IO-Link master and EMCS-ST.

Index. Subindex	Name	Description	Data type (length)	User access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
ProcessDataInput (Device ➔ Master)						
0x0028.1 (40.1)	‘State "In"’	Status at "Lim_{In} (Ref)" ➔ 15.2.6 Monitor point-to-point operation via IO-Link end position – true: "Lim_{In} (Ref)" end position reached. – false: "Lim_{In} (Ref)" end position not reached	BooleanT (1 bit)	R	R	R
0x0028.2 (40.2)	‘State "Out"’	Status at "Lim_{Out}" end position ➔ 15.2.6 Monitor point-to-point operation via IO-Link – true: "Lim_{Out}" end position reached – false: "Lim_{Out}" end position not reached	BooleanT (1 bit)	R	R	R
0x0028.3 (40.3)	‘State "Move"’	Status of the drive motion – true: drive in motion – false: drive at standstill	BooleanT (1 bit)	R	R	R
0x0028.4 (40.4)	‘State "Device"’	Status of the drive unit – true: drive unit ready for operation – false: drive unit not ready for operation	BooleanT (1 bit)	R	R	R
0x0028.5 (40.5)	‘State "Intermediate"’	Status at intermediate position "Pos_{Imp}" (from FW version v19.0.4.107_release) ➔ 15.2.6 Monitor point-to-point operation via IO-Link – true: intermediate position "Pos_{Imp}" reached – false: intermediate position "Pos_{Imp}" not reached	BooleanT (1 bit)	R	R	R

Index. Subindex	Name	Description	Data type (length)	User access[1)] U = User M = Maintenance personnel S = Specialist		
				U	M	S
ProcessDataOutput (Master ➔ Device)						
0x0029.1 (41.1)	‘Move "In"’	Control command for executing the motion "Mov_{In}" to the "Lim_{In}(Ref)" end position. – The control command only works in combination with the bits – 0x0029.2: move "Out" – 0x0029.5: move "Intermediate" ➔ 15.2.5 Control point-to-point operation via IO-Link. – Corresponds to the function of digital input 1 (DI1).	BooleanT (1 bit)	R/W	R/W	R/W
0x0029.2 (41.2)	‘Move "Out"’	Control command for executing the motion "Mov_{Out}" to the "Lim_{Out}" end position. – The control command only works in combination with the bits – 0x0029.1: move "In" – 0x0029.5: move "Intermediate" ➔ 15.2.5 Control point-to-point operation via IO-Link. – Corresponds to the function of digital input 2 (DI2).	BooleanT (1 bit)	R/W	R/W	R/W

Index. Subindex	Name	Description	Data type (length)	User access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
0x0029.3 (41.3)	‘Quit Error’	Control command for acknowledging errors – true: start error acknowledgement – false: do not start error acknowledgement	BooleanT (1 bit)	R/W	R/W	R/W
0x0029.5 (41.5)	‘Move "Intermediate"’	Control command for executing the movement "Mov_{Imp}" to the intermediate position "Pos_{Imp}" (from FW version v19.0.4.107_release) – The control command only works in combination with the bits – 0x0029.1: move "In" – 0x0029.2: move "Out" ➔ 15.2.5 Control point-to-point operation via IO-Link.	BooleanT (1 bit)	R/W	R/W	R/W

1) R/W = read and write, R = read only, W = write only

Tab. 47: Process data

‘ProcessDataInput’	Bit							
	15	...	5	4[1]	3	2	1	0
Control data	–			‘State "Intermediate"’	‘State "Device"’	‘State "Move"’	‘State "Out"’	‘State "In"’
Index.Subindex				0x0028.5 (40.5)	0x0028.4 (40.4)	0x0028.3 (40.3)	0x0028.2 (40.2)	0x0028.1 (40.1)

1) From firmware version v19.0.4.107_release

Tab. 48: Telegram structure ‘ProcessDataInput’

‘ProcessDataOutput’	Bit							
	15	...	5	4[1)]	3	2	1	0
Status data	–			‘Move "Intermediate"’	–	‘Quit Error’	‘Move "Out"’	‘Move "In"’
Index.Subindex				0x0029.5 (41.5)	–	0x0029.3 (41.3)	0x0029.2 (41.2)	0x0029.1 (41.1)

1) From firmware version v19.0.4.107_release

Tab. 49: Telegram structure ‘ProcessDataOutput’

15.2.4 System parameters

The system parameters ‘System-Commands’ contain all command data (e.g. start and stop, power stage control, ...) displayed as buttons in the application software interface to control the drive system.

Index. Subindex	Name	Description	Data type (length)	User access[1)] U = User M = Maintenance personnel S = Specialist		
				U	M	S
0x0002.0 (2.0)	‘System-Commands’	System commands for controlling the drive unit	UIntegerT (1 bytes)	–	W	W
		Value 0xC8 (200) ‘execute "Move$_{In}$"’ – Control command for executing the motion "Mov$_{In}$" to the "Lim$_{In}$("Ref")" end position ➔ 15.2.5 Control point-to-point operation via IO-Link.				
		Value 0xC9 (201) ‘execute "Move$_{Out}$"’ – Control command for executing the motion "Mov$_{Out}$" to the "Lim$_{Out}$" end position ➔ 15.2.5 Control point-to-point operation via IO-Link.				
		Value 0xCA (202) ‘Stop motion’ – Control command for stopping travel. ➔ 15.2.5 Control point-to-point operation via IO-Link.				
		Value 0xCB (203) ‘Disable power stage’ – Control command for switching off the power stage. ➔ 15.2.5 Control point-to-point operation via IO-Link.				

Index. Subindex	Name	Description	Data type (length)	User access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S
0x0002.0 (2.0)	'System-Commands'	**Value 0xCC (204): 'Enable power stage'** – Control command for switching on the power stage. The current position Pos_{Act} of the drive is maintained position-controlled.	UIntegerT (1 bytes)	–	W	W
		Value 0xCD (205): 'Restore factory settings' – Control command to reset the drive unit to factory settings ➔ 10.2.4 Factory settings. – After reset to the factory settings, the drive must be referenced ➔ 10.3.2 Homing with end position determination.				

		Value 0xCE (206): 'Execute "Reference" Movement (False)'
		– Control command for executing homing with end position determination according to (factory setting):
		  – Linear drive systems: motor-facing reference end position "Ref"
		  – Rotary drive systems (ERMS: view of the rotating plate): left reference end position "Ref"				

Index. Subindex	Name	Description	Data type (length)	User access[1] U = User M = Maintenance personnel S = Specialist		
				U	M	S

0x0002.0
(2.0)
	'System-Commands'	**Value 0xCF (207): 'Execute "Reference" Movement (True)'**
		– Control command for executing homing with end position determination to:
		  – Linear drive systems: reference end position "Ref" motor facing away
		  – Rotary drive systems (ERMS: view of the rotating plate): right reference end position "Ref"
			UIntegerT
			(1 bytes)
				–	W	W

		Value 0xD0 (208): 'Execute "Move Intermediate"' (from firmware version v19.0.4.107_release) – Control command for executing the movement "Mov_{Imp}" to the intermediate position "Pos_{Imp}" ➔ 15.2.5 Control point-to-point operation via IO-Link.				

1) R/W = read and write, R = read only, W = write only

Tab. 50: System parameters

15.2.5 Control point-to-point operation via IO-Link

The following table shows the combinations of the 'Move "In"', 'Move "Out" ' and 'Move "Intermediate"' process parameters via IO-Link and the 'System-Commands' system parameters in the application software for controlling the drive in point-to-point mode.

Process parameters			**System parameters**	**Description**
‘Move "In"’ 0x0029.1	‘Move "Out"’ 0x0029.2	‘Move "Inter-mediate"’ [1] 0x0029.5	‘System-Commands’ 0x0002	
Stop motion				
false	false	false	‘Stop motion’ 0xCA (202)	Control command for stopping travel. – The power stage remains active. – The drive decelerates to standstill. – The drive remains at position-controlled standstill.
Execute movement				
false	true	false	‘Execute "$Move_{Out}$"’ 0xC9 (201)	Control command for executing the motion "Mov_{Out}". – The drive moves towards the "Lim_{Out}" end position under position control. – In point-to-point operation with press function the drive travels from the “Start Press” position to the “Lim_{Out}” end position under force control. – After a restart, the "Ref" reference end position is re-initialised first.
true	false	false	‘Execute "$Move_{In}$"’ 0xC8 (200)	Control command for executing the motion "Mov_{In}". – The drive moves towards the "Lim_{In}(Ref)" end position under position control. – After a restart, the "Ref" reference end position is re-initialised first.

Process parameters			System parameters	Description
‘Move "In"’	‘Move "Out"’	‘Move "Intermediate"’ 1)	‘System-Commands’	
0x0029.1	0x0029.2	0x0029.5	0x0002	
false	false	true	‘Execute "Move$_{Intermediate}$"’ 0xD0 (208)	Control command for executing the movement "Mov$_{Imp}$" (from firmware version v19.0.4.107_release) – The drive moves position-controlled in the direction of the intermediate position "Pos$_{Imp}$". – In point-to-point operation with press function, the drive travels from the "Start Press" position to the intermediate position "Pos$_{Imp}$. – After a restart, the "Ref" reference end position is re-initialised first.
Interrupt movement, switch off output stage, acknowledge error				
true	true	false	‘Disable power stage’ 0xCB (203)	– Control command for switching off the power stage. – The power stage is switched off after 3 s. – The drive coasts to a standstill. – At standstill, the drive remains stopped unregulated. – Control command for acknowledging errors (only with 0x0029.1 / 2/5 = true / true / any) – The error is automatically deleted from the diagnostic memory on acknowledgement.
false	true	true		
true	false	true		
true	true	true		

1) From firmware version v19.0.4.107_release

Tab. 51: Control data via IO-Link

15.2.6 Monitor point-to-point operation via IO-Link

The current position of the drive in point-to-point operation can be monitored via the process parameters. The following table shows the process commands for monitoring the drive position.
The following table shows the combinations of the ‘State$_{In}$’, ‘State$_{Out}$’ and ‘State "Intermediate"’ process parameters via IO-Link for monitoring the drive in point-to-point operation.

Process parameters			Description
'State$_{In}$' 0x0028.1	'State$_{Out}$' 0x0028.2	'State "Intermediate"'[1] 0x0028.5	
false	false	false	– The drive is not in one of the two end positions "Lim$_{In}$ (Ref)/ Lim$_{Out}$" or in the "Pos$_{Imp}$" intermediate position.
true	false	false	– The drive is in the "Lim$_{In}$ (Ref)" end position.
false	true	false	– The drive is in the "Lim$_{Out}$" end position. – The drive has reached the parameterised force "Force" or the end positions "Lim$_{Out}$" in the force-controlled range of point-to-point operation with press function.
false	false	true	– The drive is in the intermediate position Pos$_{Imp}$" (from firmware version v19.0.4.107_release)
true	true	any	– critical error ➔ 12.2.2 Diagnostic messages and fault clearance.

1) From firmware version v19.0.4.107_release

Tab. 52: Status data via IO-Link

16 Technical data

16.1 Technical data, general

EMCS-ST		-42	-57
Type of mounting		Direct fastening to drive, screw-fastened	
Mounting position		Any	
Dimensions (HxWxD)	[mm]	81.3 x 42.3 x 89.0	95.6 x 56.6 x 94.1
Product weight	[kg]	Approx. 0.51	Approx. 0.85
Duty cycle	[%]	100 (up to 30 °C) ➔ Fig. 31	
Transport temperature	[°C]	–25 … +70	
Relative humidity	[%]	0 … 90, non-condensing	
Max. transportation duration	[d]	30	
Ambient temperature	[°C]	0 … +50	
Ambient temperature with reduction of duty cycle "–2%/°C"	[°C]	30 … 50 ➔ Fig. 31	

EMCS-ST		-42	-57
Permissible setup altitude above MSL	[m]	0 … 4000	
Setup altitude above MSL with reduction of duty cycle "–1.2%/100 m"	[m]	1000 … 4000	
Degree of protection with and without mating plug [Logic] [Power]		IP40	
Insulation class according to EN 60034-1		B (130 °C)	
Protection class		III, safety extra-low voltage	
Overvoltage category		III	
Pollution degree		2	
Service life	[h]	20000 (if derating is adhered to)	
Certificates, declaration of conformity		➔ www.festo.com/sp	
Vibration resistance in accordance with EN 61800-2 and EN 61800-5-1		Severity level 2	
Shock resistance in accordance with EN 61800-2		Severity level 2	

Tab. 53: Technical data, general

Features of severity level (SL)					
Vibration load					
Frequency range [Hz]		Acceleration [m/s²]		Deflection [mm]	
SL1	SL2	SL1	SL2	SL1	SL2
2 … 8	2 … 8	–	–	±3.5	±3.5
8 … 27	8 … 27	10	10	–	–
27 … 58	27 … 60	–	–	±0.15	±0.35
58 … 160	60 … 160	20	50	–	–
160 … 200	160 … 200	10	10	–	–

Features of severity level (SL)					
Shock load					
Acceleration [m/s²]		Duration [ms]		Shocks per direction	
SL1	SL2	SL1	SL2	SL1	SL2
±150	±300	11	11	5	5
Continuous shock load					
Acceleration [m/s²]		Duration [ms]		Shocks per direction	
±150		6		1000	

Tab. 54: Features of severity level (SL)

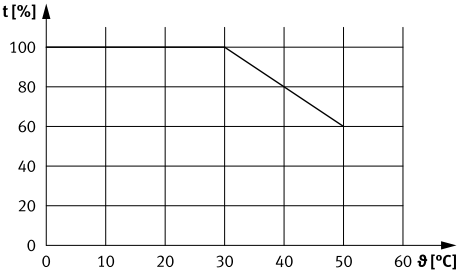


Fig. 31: Duty cycle t as a function of ambient temperature ϑ

16.2 Technical data, electrical

16.2.1 Power supply

EMCS-ST		-42	-57
Load voltage supply			
Nominal voltage	[V DC]	24	
Voltage range	[V DC]	24 ± 15 %	
Nominal current at 24 V	[A]	3.0	5.3
Protective functions		– Protection against polarity reversal – Overcurrent protection, 10 A fuse, cannot be reset	
Logic voltage supply (DIO and IO-Link operation)			
Nominal voltage	[V DC]	24	
Voltage range	[V DC]	24 ± 15 %	
Logic current consumption (Logic, Pin 1) loaded with rotary encoder and display components			
– DIO operation	[A]	0.1 ... 0.3	
– IO-Link operation	[A]	0.1 ... 0.15	
Protective functions		– Protection against polarity reversal – Overcurrent protection, 2 A fuse, cannot be reset	

Tab. 55: Technical data: power supply

16.2.2 Digital inputs (DI)

Damage to the device due to non-approved potentials at the pins

- [Power] connection:
  - Do not connect pin 3

When using hardware version "Rev02" or "RevB" or older, check additional precautionary measures to avoid damage to the device due to impermissible potentials on the pins in the corresponding version of the documentation ➔ www.festo.com/sp

EMCS-ST		-42	-57
Nominal voltage	[V DC]	24	
Voltage range	[V DC]	–3 … +30	
Level			
Logic level based on EN 61131-2, Type 1		PNP, NPN	
Min. pulse length (high or low)	[ms]	20	
High level (1) for PNP[1] per input			
Max. input voltage $U_{H\ max}$	[V]	30	
Min. input voltage $U_{H\ min}$	[V]	15	
Max. input current $I_{H\ max}$	[A]	0.015	
Min. input current $I_{H\ min}$	[A]	0.002	
Low level (0) for PNP[1] per input			
Max. input voltage $U_{L\ max}$ at $I_{L\ max}$ >0.5/≤0.5	[V]	5/15	
Min. input voltage $U_{L\ min}$	[V]	–3	
Max. input current $I_{L\ max}$	[A]	0.015	
Min. input current $I_{L\ min}$	[A]	–	

1) The understanding of NPN is reversed. However, the values and the function are identical.

Tab. 56: Technical data, digital inputs (DI)

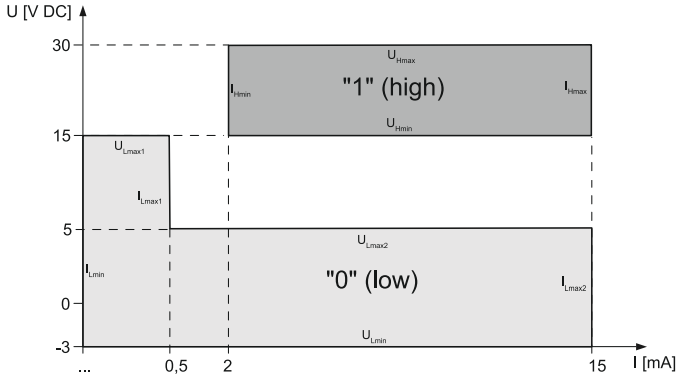


Fig. 32: Working ranges of the digital inputs (DI) for PNP

16.2.3 Digital outputs (DO)

EMCS-ST		-42	-57
Nominal voltage	[V DC]	24	
Voltage range	[V DC]	0 … 30	
Level per output			
Logic level based on EN 61131-2, Type 1		PNP, NPN	
Max. permissible output current	[A]	0.1	
Protective function		– short-circuit proof – feedback-proof – overvoltage-proof up to 30 V	

Tab. 57: Technical data, digital outputs (DO)

16.2.4 IO-Link

Damage to the device due to non-approved potentials at the pins

- Power connection:
  - Do not connect pin 3
- GND and L– connections:
  - Apply the Power, GND [Pin 2] and Logic, GND/L– [Pin 4/8] connections to one potential. For example, ensure the same potential by using a common fixed power supply or an electrical connection of the two 0 V DC GND potentials.

When using hardware version "Rev02" or "RevB" or older, check additional precautionary measures to avoid damage to the device due to impermissible potentials on the pins in the corresponding version of the documentation ➔ www.festo.com/sp

Automatic storage of device data

If automatic storage is activated (0x0109.0 = true, default), parameter changes in the device data (= data storage parameters ➔ "Integrated drive EMCS" instruction manual ➔ www.festo.com/sp) are made automatically and permanently saved in the flash memory. Exceeding the maximum permissible 100,000 write cycles results in irreparable damage to the flash memory and the device, e.g. when using the device for positioning tasks via IO-Link.
If automatic storage is deactivated (0x0109.0 = false), parameter changes are only temporarily stored in the RAM. The RAM permits an unlimited number of parameter changes, e.g. for positioning tasks via IO-Link.

EMCS-ST		**-42**	**-57**
Protocol version		1.1.2	
Profile		– Common Profile – Firmware Update Profile	
Function classes		– Device identification – Device diagnosis – Process data mapping – Extended identification	
Communication mode		COM3 (230.4 kbaud)	
SIO-Mode support		Yes	
Port class		A	
Process data length OUT	[Byte]	2	
Process data content OUT		– 1 bit (Move In) – 1 bit (Move Out) – 1 bit (Quit Error) – 1 bit (Move Intermediate) (from firmware version v19.0.4.107_release)	
Process data length IN	[Byte]	2	
Process data content IN		– 1 bit (State In) – 1 bit (State Out) – 1 bit (State Move) – 1 bit (State Device) – 1 bit (State Intermediate) (from firmware version v19.0.4.107_release)	
Min. cycle time	[ms]	1	
Data storage required	[Kbyte]	0.5	
Device ID		➔ 15.2.1 Identification parameters	
Logic current consumption (Logic, Pin 1)	[A]	0.1 ... 0.15	

Tab. 58: Technical data, IO-Link

16.2.5 Motor, integrated

EMCS-ST		-42	-57
Nominal current	[A_{RMS}]	3	5
Holding torque	[Nm]	0.45	0.8
Maximum speed	[rpm]	1700	
Step angle	[°]	1.8	
Step angle tolerance	[%]	5	
Total output moment of inertia	[kgcm²]	0.082	0.3
Motor constant	[Nm/A]	0.15	0.16
Thermal time constant	[s]	123	143
Current regulator cycle time	[µs]	50	

Tab. 59: Technical data, motor

16.2.6 Rotary encoder (integrated)

Type		EMCS-ST-42-...	EMCS-ST-57-...
Single-turn angular resolution	[bit]	16 (65536 steps/revolution)	
Multi-turn encoder		No	

Tab. 60: Technical data, absolute encoder single-turn

16.2.7 Temperature sensor, integrated

EMCS-ST		-42	-57
Warning threshold overtemperature	[°C]	75 ... 85	
Warning threshold undertemperature	[°C]	–5 ... +5	
Limit value (error) Overtemperature	[°C]	>85	
Limit value (error) Undertemperature	[°C]	< –5	

Tab. 61: Technical data, power stage temperature monitoring

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