Application Note

FESTO

Simplified Motion Series Firmware Update with CDSU-1 and CPX-AP-I IO-Link Master

This Application Note explanation is about Simplified Motion Series actuator units (EPCE, EPCS-BS, EGSS, ELGS-BS/TB, ELGE, ERMS) Firmware Update with CDSU-1 and CPX-AP-I IO-Link Master

EPCE
EPCS-BS
EGSS
ELGS-BS
ELGS-TB
ELGE
ERMS

100355

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Author .....Festo

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Legal Notice

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1 Introduction

This application note shows how to update the Simplified Motion Series actuator units (EPCE, EPCS-BS, EGSS, ELGS-BS/TB, ELGE, ERMS) Firmware to the latest version V 19.0.4.107_release with the following Festo IO-Link Masters:

- CDSU-1 IO-Link Master USB

- CPX-AP-I IO-Link Master

Note

- Firmware Update is also possible with third party IO-Link Masters supporting IO-Link Firmware Update Profile.
- This Application Note is concentrating on Firmware Update with supporting Festo IO-Link Masters.

2 Firmware Update with CDSU-1 IO-Link Master

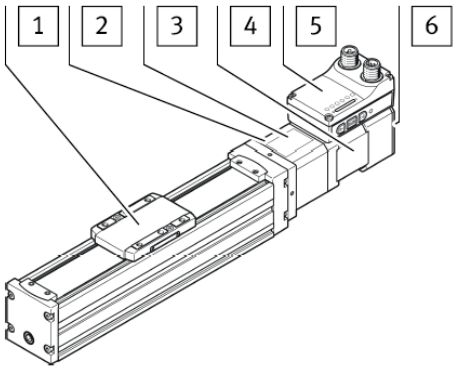
2.1 Hardware & Software Requirements

Following hard- and software is needed to write new firmware on EMCS-ST motor with CDSU-1 IO-Link Master:

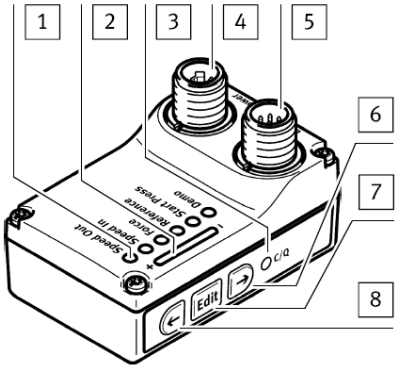
Device Name	Part Number	Version Software/Firmware	Device Type
Any Simplified Motion Series actuator unit (EPCE, EPCS-BS, EGSS, ELGS-BS/TB, ELGE, ERMS)	-	-	Hardware
Festo IO-Link Master USB	8091509 CDSU-1	V2.0.4.5 or higher	Hardware
Power supply unit for IO-Link Master USB	-	-	Hardware
Mini USB cable type A	-	-	Hardware
Adapter cable	8080777 NEFC-M12G8-0.3-M12G5-LK	-	Hardware
Power supply cable	e.g. 8080790 NEBL-T12G4-E-2-N-LE4	-	Hardware
Power supply unit 24 V DC for load power supply of EMCS-ST	-	-	Hardware
Laptop	-	-	Hardware
EMCS-ST Firmware	-	EMCS_ST_V019.0.4.107_release	Software
IODD for SMS-unit	-	V 1.2.6 or higher	Software
CDSU USB IO-Link Master Tool	-	V 1.1.3 or higher	Software

Table 2.1: Components/Software used

2.2 Hardware Overview



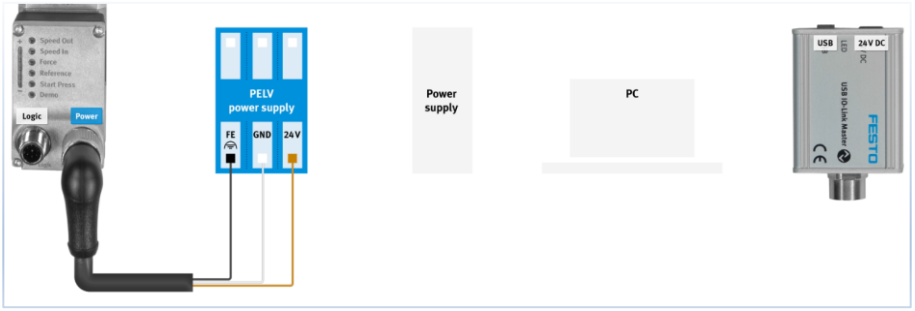
1 Spindle axis ELGC-BS
2 Axial kit EAMM
3 Product labelling
4 Integrated drive EMCS-ST
5 Controller housing
6 Warning symbol "Attention! Hot surface"



1 LED display Menu (Speed Out, ..., Demo)
2 LED parameter display
3 LED display C/Q
4 Power voltage connection [power]
5 Logic voltage and digital I/O or IO-Link [Logic] connection
6 Pushbutton actuator (right arrow)
7 Pushbutton actuator (Edit)
8 Pushbutton actuator (left arrow)

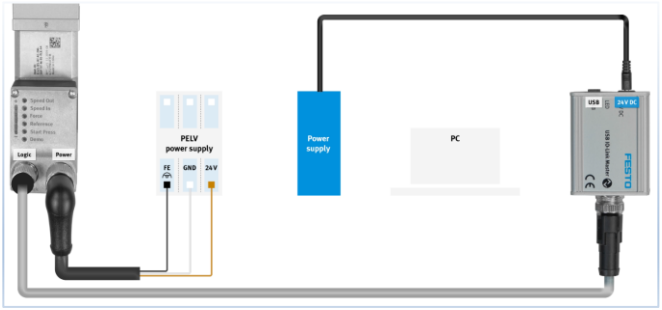
2.3 Mechanical and electrical commissioning

1. Connect load power supply of EMCS-ST to power supply unit

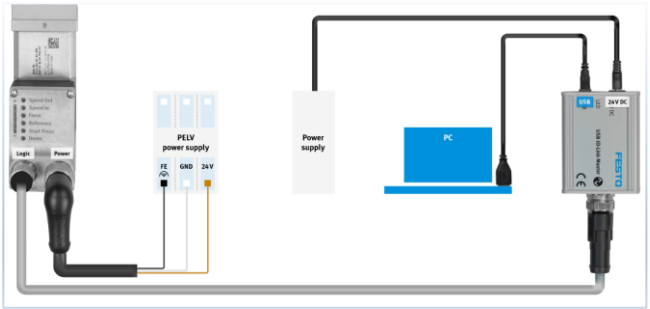


2. Connect EMCS-ST with CDSU-1 IO-Link Master using NEFC-adapter cable

3. Connect CDSU-1 IO-Link Master with external power supply



4. Connect CDSU-1 IO-Link Master to Windows Laptop using USB-cable



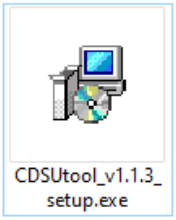
Note

First connect / switch on load power supply “Power”, then connect logic power

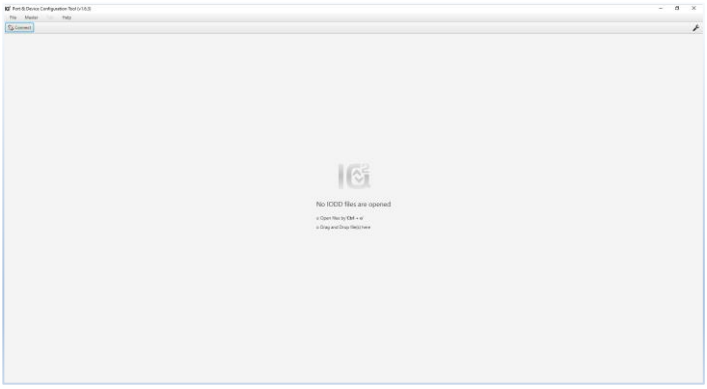
⇨ Watch sequence, otherwise EMCS-ST will fall in error directly after connecting logic power.

2.4 Software commissioning

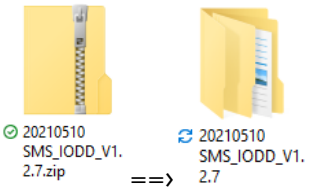
1. Install CDSU Windows laptop software for CDSU-1 – Version 1.1.3



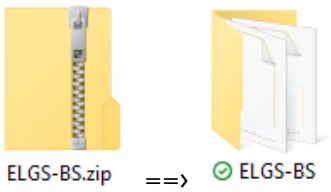
2. Open installed CDSU Windows laptop software for CDSU-1



3. Unpack and load IODDs for SMS “SMS_IODD_V1.2.7.zip”

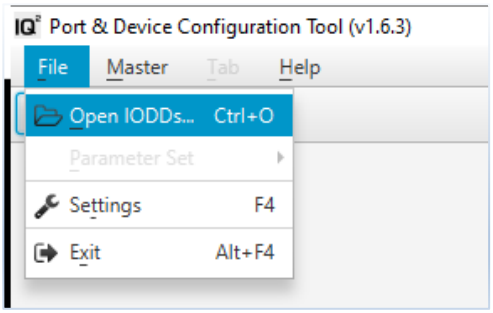


4. Unpack and load IODD for e.g. ELGS-BS “ELGS-BS.zip” inside “SMS_IODD_1.2.7” folder

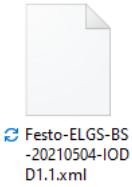


6. Open IODD for ELGS-BS in CDSU Windows laptop software for CDSU-1

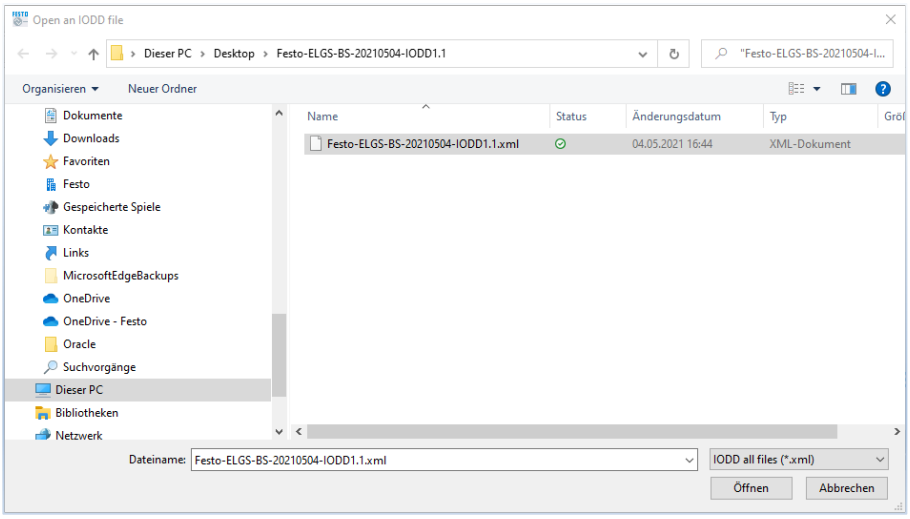
   - Press **“File”**
   - Press **“Open IODDs”**



   - Select IODD for ELGS-BS **“Festo-ELGS-BS-20210504-IODD1.1.xml “**

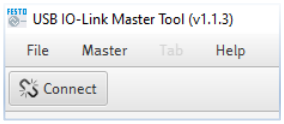


   - Press **“Open”**

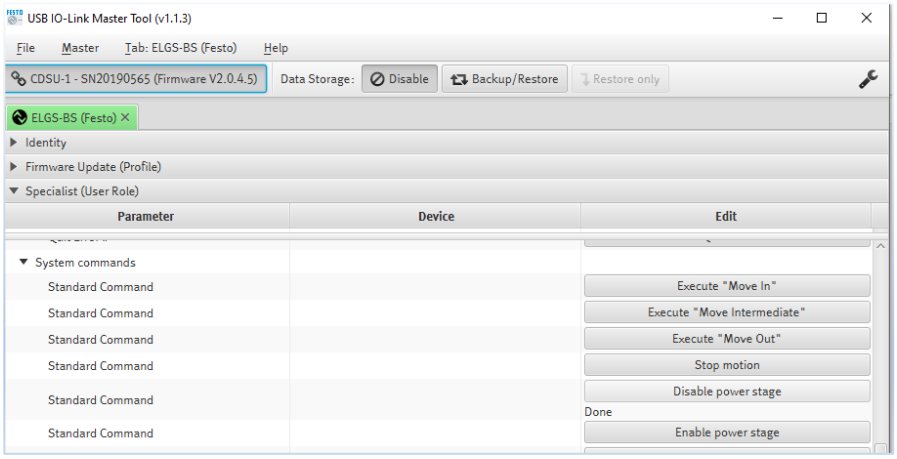


2.5 Load Firmware

1. Establish IO-Link connection between CDSU-1 IO-Link Master and ELGS-BS
    - Press **“Connect”**

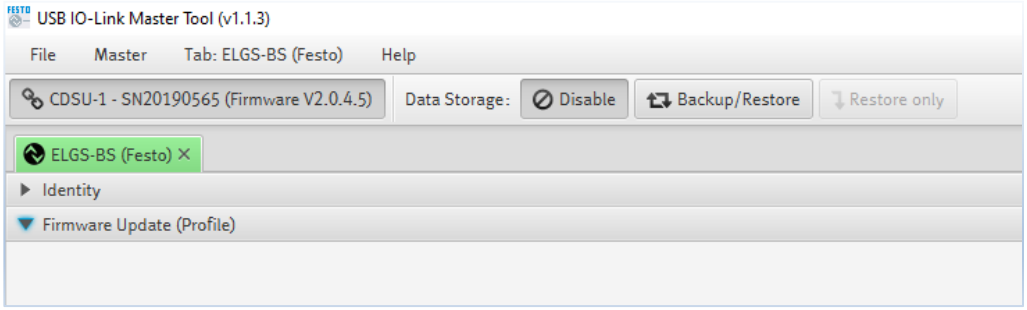


2. Disable power end stage in “Specialist (User Role)” register card
    - Press **“Disable power stage”**

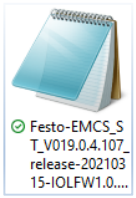


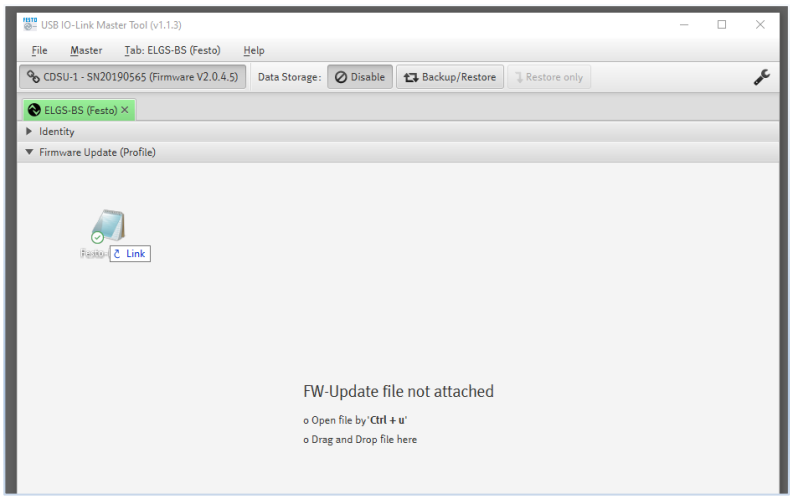
➔ **Note**
Without disabling power end stage firmware update will not work out!

3. Open area “Firmware Update (Profile)” in register card “ELGS-BS (Festo)”
    - Press **“Firmware Update (Profile)”**

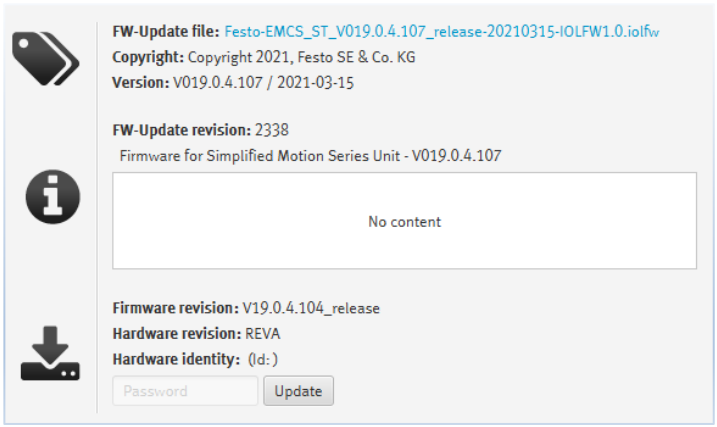


5. Open firmware file in register card “Firmware Update (Profile)”
    - By keyboard combination **“Ctrl + o”**
    - Or by drag and drop
    - Select firmware-file: **“Festo-EMCS_ST_V019.0.4.107_release-20210315-IOLFW1.0.iolfw”**

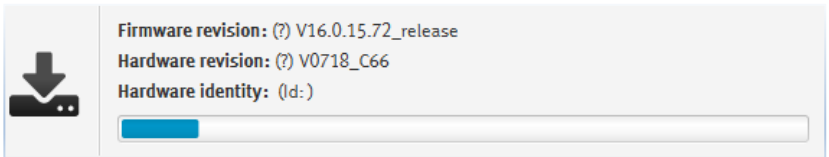




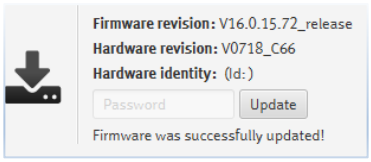
6. Load firmware file in integrated drive unit
    - Press **“Update”**



7. Now wait till loading is completed (watch progress bar) – this will take ~ 30 min
    - Firmware Update Package is downloaded to device – this will take ~ 30 min



- Progress bar disappears when parameter is successfully loaded
- Information: “Software was successfully updated” will show up, when loading is completed



2.6 Update Firmware

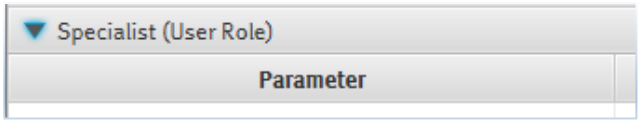
Note

If starting (old) firmware on the device is version V16.0.18.92 or older, all steps in this chapter have to be executed mandatory.

If starting (old) firmware on the device is firmware V19.0.4.107 or newer, jump directly to point 3.

1. Open area “Specialist (User Role)” in register card “ELGS-BS (Festo)”

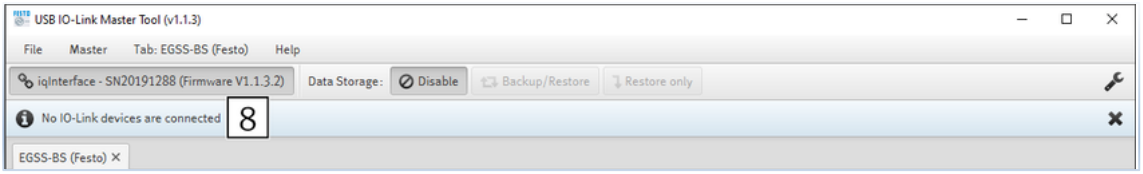
   - Press **“Specialist (User Role)”**



2. Open “file handling commands” in parameters

   - Press **“File handling commands”**
   - For parameter **“Enable file handling”** select **“Enable file handling”**
   - Press **“Write”**
   - … then …
   - For parameter **“Execute file handling”** select **“Execute firmware update”**
   - Press **“Write”**

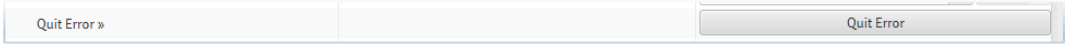
3. After firmware update was executed, integrated drive unit will do restart automatically
   IO-Link connection will be interrupted therefore



4. After successful restart, IO-Link connection will be re-established automatically

5. Quit active error messages

   - Open **“Control parameters”**
   - For parameter **“Quit Error”** press **“Quit Error”**



6. Check FW-version

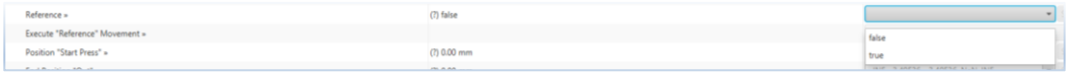
   - Open **“Identification parameters”**
   - Check version for parameter **“Firmware version”**

7. Firmware-update is now done!

2.7 Re-Reference actuator system (optional)

1. Open area “Specialist (User Role)” in register card “ELGS-BS (Festo)”
    - Press **“Specialist (User Role)”**

2. Optional – if necessary:
    - Select / change “Reference” end position for reference movement (default = motor side)
    - Select corresponding value at parameter “Reference”
        - False = motor side (Rotary = left)
        - True = motor averted (Rotary = right)



3. Execute Reference movement
    - Press **“Execute Reference movement”** in corresponding parameter

    - Wait for reference movement to be executed and actuator movement stops completely.
    - Actuator will move to both end positions and stops automatically when finished.

➔ **CAUTION**
Actuator will start moving for this process. Watch your fingers!

4. Check functionality of actuator and movement by using system commands “Execute Move In” and “Execute Move Out” in System commands
    - Press **“Execute Move In” or “Execute Move Out” in system commands**

➔ **CAUTION**
Actuator will start moving. Watch your fingers!

3 Firmware Update with CPX-AP-I-4IOL IO-Link Master

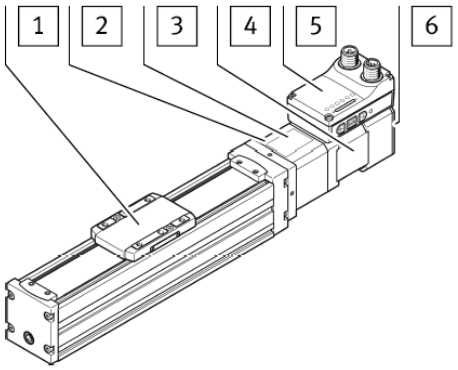
3.1 Hardware & Software Requirements

Following hard- and software is needed to write new firmware on EMCS-ST motor with CPX-AP-I IO-Link Master:

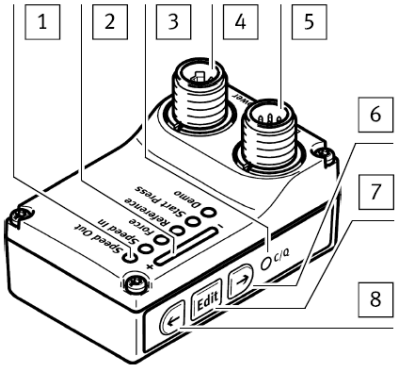
Device Name	Part Number	Version Software/Firmware	Device Type
Any Simplified Motion Series actuator unit (EPCE, EPCS-BS, EGSS, ELGS-BS/TB, ELGE, ERMS)	-	-	Hardware
Festo IO-Link Master	CPX-AP-I-4IOL-M12	V1.1.3 or higher	Hardware
Festo CPX-AP-I Head Module	CPX-AP-I-EP/EC/EN/PB-M12	V1.2.2 or higher	Hardware
CPX Module Connecting Cable	e.g. 8082902 NEBC-D8G4-ES-0.3-N-S-D8G4-ET	-	Hardware
CPX Module Power Cable	e.g. 8065110 NEBL-M8G4-E-5-N-LE4	-	Hardware
Power supply unit for IO-Link Master	-	-	Hardware
Adapter cable	8080777 NEFC-M12G8-0.3-M12G5-LK	-	Hardware
Connecting cable	e.g. 8091511 NEBU-M12G5-K-1-N-M12G3	-	Hardware
Power supply cable	e.g. 8080790 NEBL-T12G4-E-2-N-LE4	-	Hardware
Power supply unit 24 V DC for load power supply of EMCS-ST	-	-	Hardware
Laptop	-	-	Hardware
EMCS-ST Firmware	-	EMCS_ST_V019.0.4.107_release	Software
IODD for SMS-unit	-	V 1.2.6 or higher	Software
Festo IO-Link Tool	-	Revision 5.1.1	Software

Table 3.1: Components/Software used

3.2 Hardware Overview



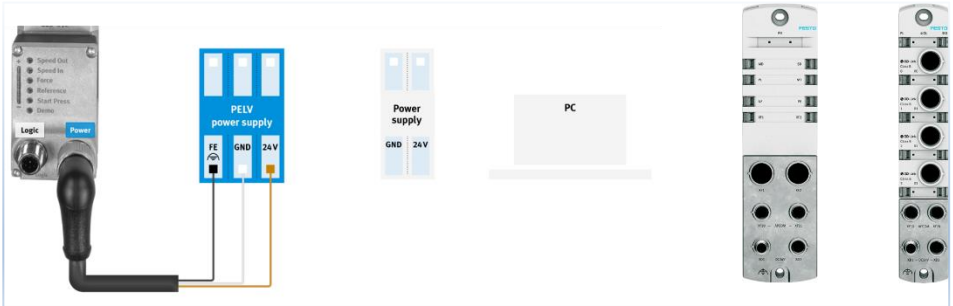
1 Spindle axis ELGC-BS
2 Axial kit EAMM
3 Product labelling
4 Integrated drive EMCS-ST
5 Controller housing
6 Warning symbol "Attention! Hot surface"



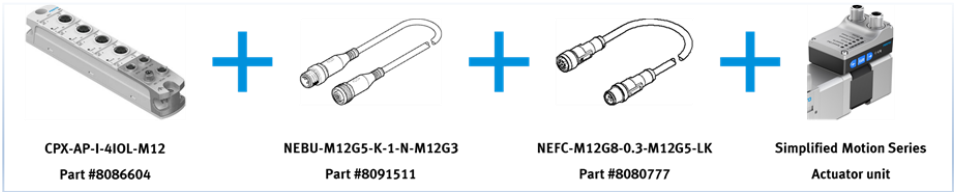
1 LED display Menu (Speed Out, ..., Demo)
2 LED parameter display
3 LED display C/Q
4 Power voltage connection [power]
5 Logic voltage and digital I/O or IO-Link [Logic] connection
6 Pushbutton actuator (right arrow)
7 Pushbutton actuator (Edit)
8 Pushbutton actuator (left arrow)

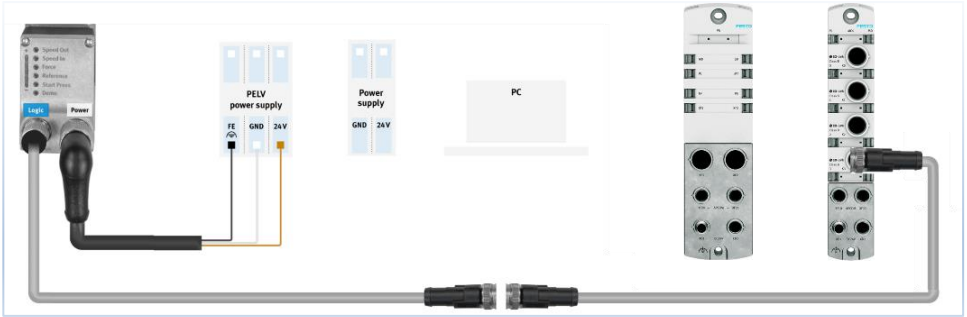
3.3 Mechanical and electrical commissioning

1. Connect load power supply of EMCS-ST to power supply unit

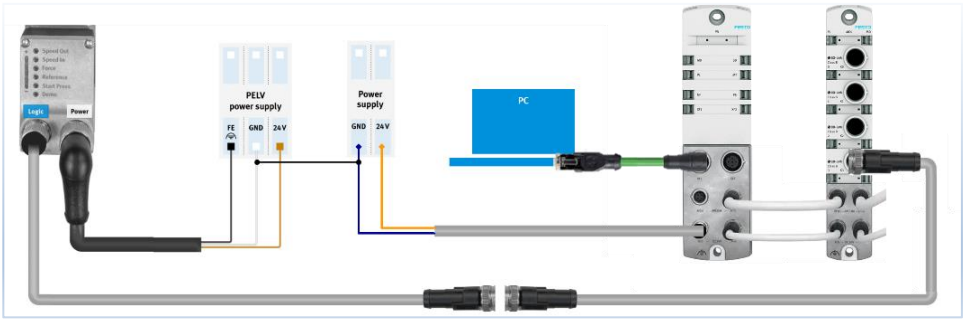


2. Connect EMCS-ST with CPX-AP-I-4IOL IO-Link Master
e.g. using following cabling solution with NEFC-adapter cable





3. Connect CPX-AP-I modules and connect CPX-AP-I head module to the laptop via Ethernet Cable

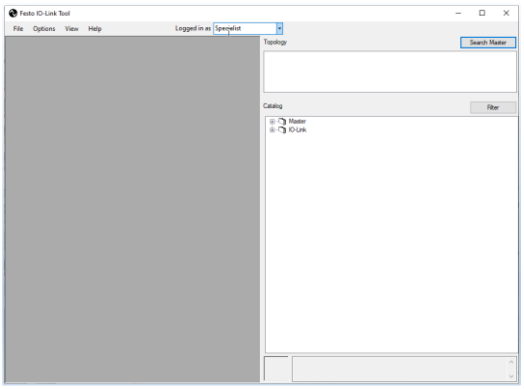


Note
First connect / switch on load power supply “Power”, then connect logic power
⇨ Watch sequence, otherwise EMCS-ST will fall in error directly after connecting logic power.

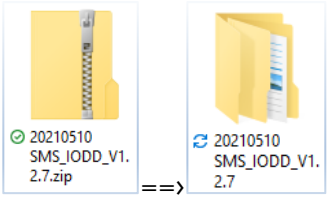
3.4 Software commissioning

1. Install Festo IO-Link Tool Rev 5.1.1 Build 6011

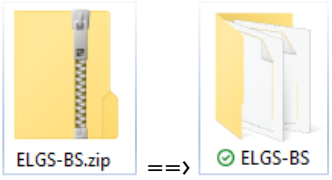
2. Open installed Festo IO-Link Tool



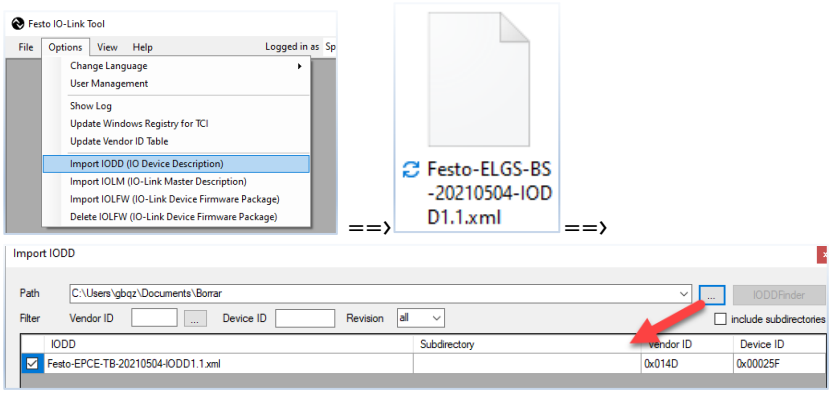
3. Unpack and load IODDs for SMS “SMS_IODD_V1.2.7.zip”



4. Unpack and load IODD for e.g. ELGS-BS “ELGS-BS.zip” inside “SMS_IODD_1.2.7” folder

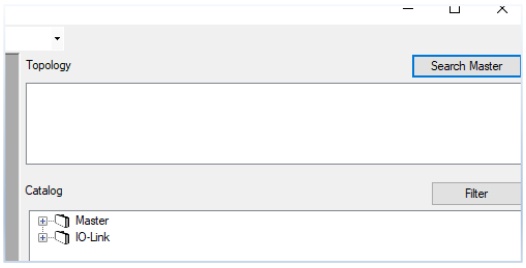


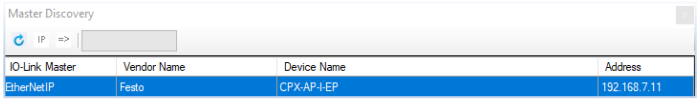
5. Open IODD for ELGS-BS in IO-Link Tool Windows laptop software for CPX-AP-I-4IOL.
   - Press **“Options”**
   - Press **“Import IODD (IO Device Description)”**
   - Press on the **“Path**  **”** and select the folder location of the IODD file.
   - Select IODD for ELGS-BS **“Festo-ELGS-BS-20210504-IODD1.1.xml “**
   - Press **“Open”**



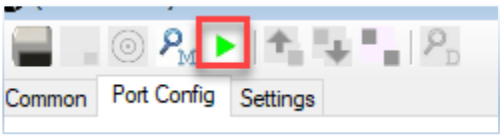
3.5 Load firmware

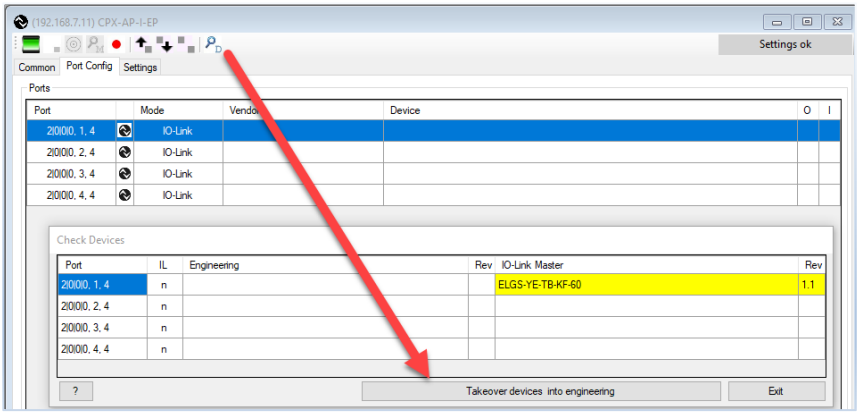
1. Establish IO-Link connection between CPX-AP-I-4IOL IO-Link Master and ELGS-BS
   - Press **“Search Master”**
   - Select the CPX-AP-I module



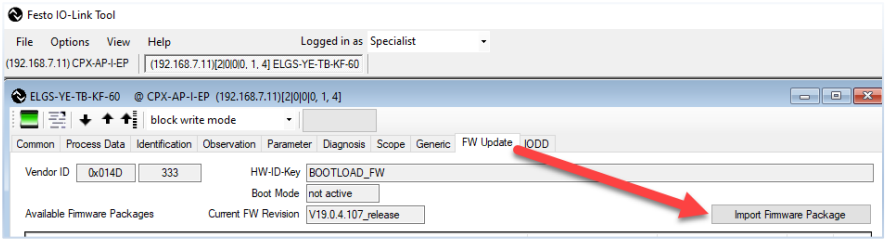


2. Go to the Port Config Tab, Log In and scan the IO-Link Devices

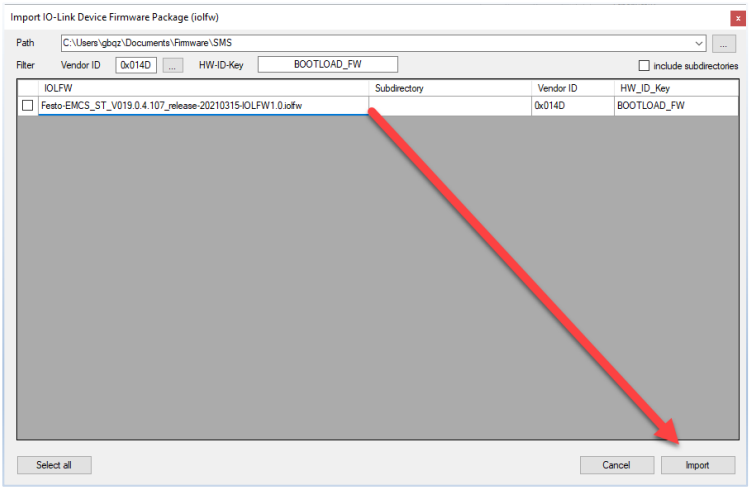




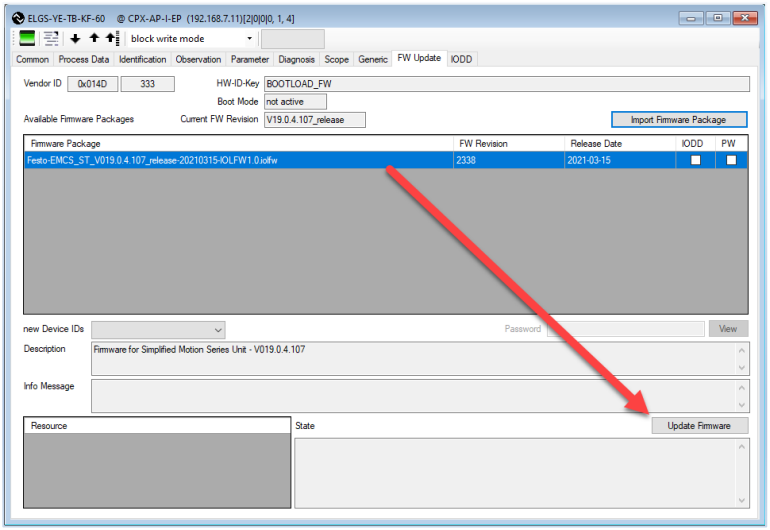
3. Double click in the device and go to the “FW Update” Tab and click on **Import Firmware Package**



4. Select firmware-file: **“Festo-EMCS_ST_V019.0.4.107_release-20210315-IOLFW1.0.iolfw**



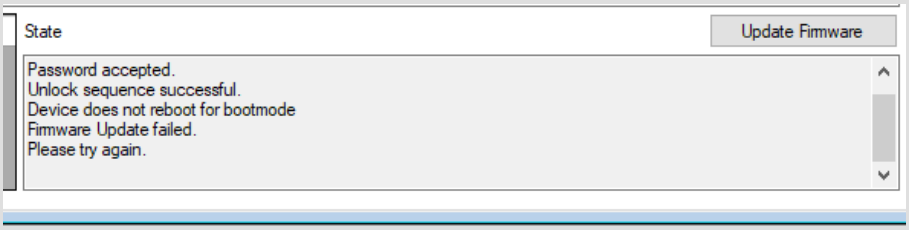
5. Highlight the firmware file and click on **Update Firmware (may take a couple of minutes)**



Important Note 1

Clicking Update Firmware the first time will generate an error.

Sometimes it is required to click on Update Firmware **twice** for it to start.



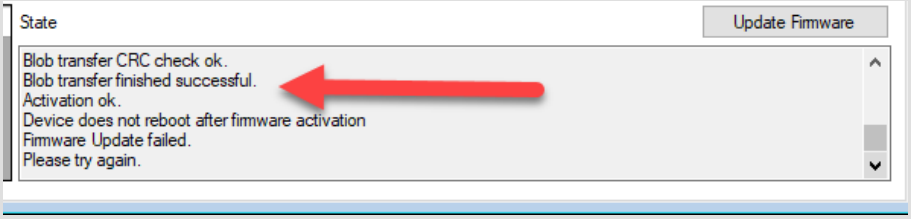
Important Note 2

When the Firmware Download to the device was done successfully, you'll read:

- Blob transfer finished successful
- Activation Ok

But

– Firmware Update failed



This is because the Simplified Motion Series actuator unit takes a longer time to reboot, and this triggers a timeout in the IO-Link Tool.

Leave the actuator ON and go on like shown in the following steps.

3.6 Update Firmware

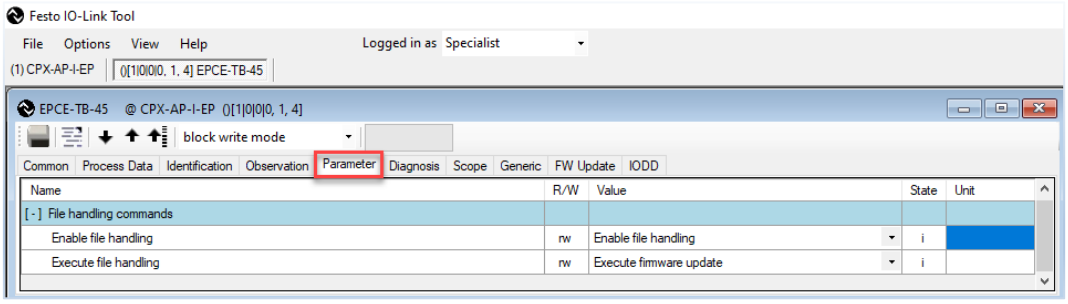
Note

If starting (old) firmware on the device is version V16.0.18.92 or older, all steps in this chapter have to be executed mandatory.

If starting (old) firmware on the device is firmware V19.0.4.107 or newer, jump directly to point 3.

1. Go to the Parameter Tab and open up Sub-Group File Handling commands

   - Press **“File handling commands”**

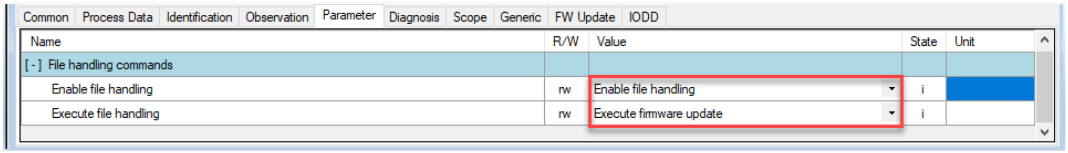


2. Open “file handling commands” in parameters

   - For parameter **“Enable file handling”** select **“Enable file handling”**
   - Press **“Write”**

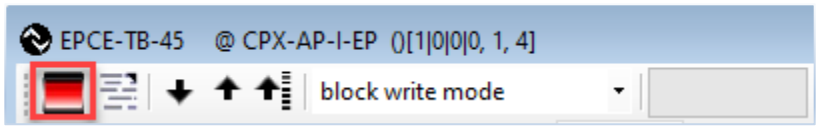
   - … then …

   - For parameter **“Execute file handling”** select **“Execute firmware update”**
   - Press **“Write”**

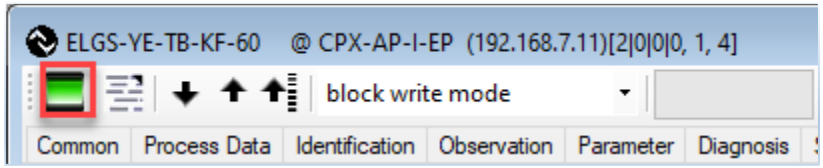


3. After firmware update was executed, integrated drive unit will do restart automatically IO-Link connection will be interrupted therefore

   Disconnected



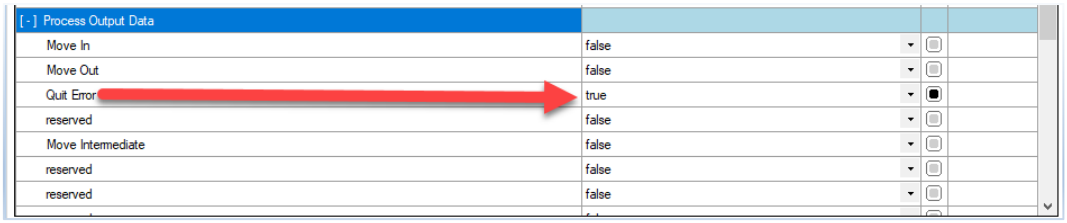
   Online



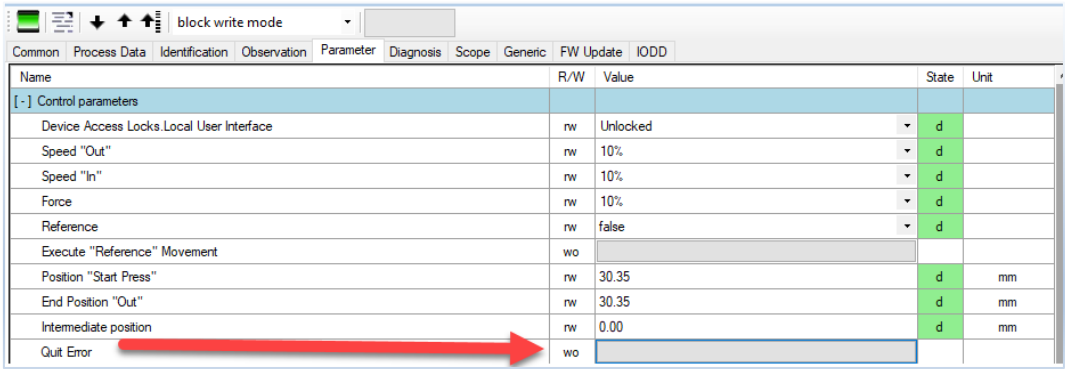
4. After successful restart, IO-Link connection will be re-established automatically

5. Quit active error messages

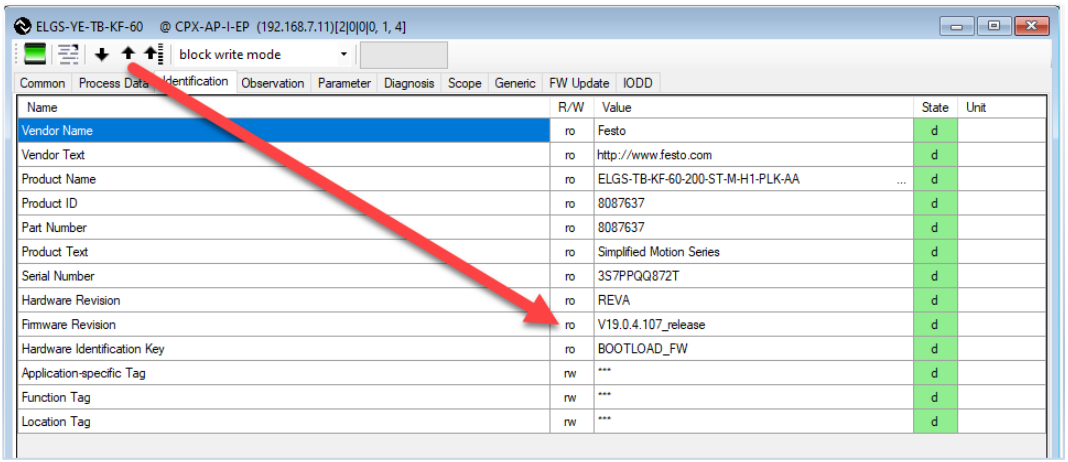
   - via the Process Data Tab -› Quit Error Output



   - via the Parameter Tab -› Quit Error Parameter



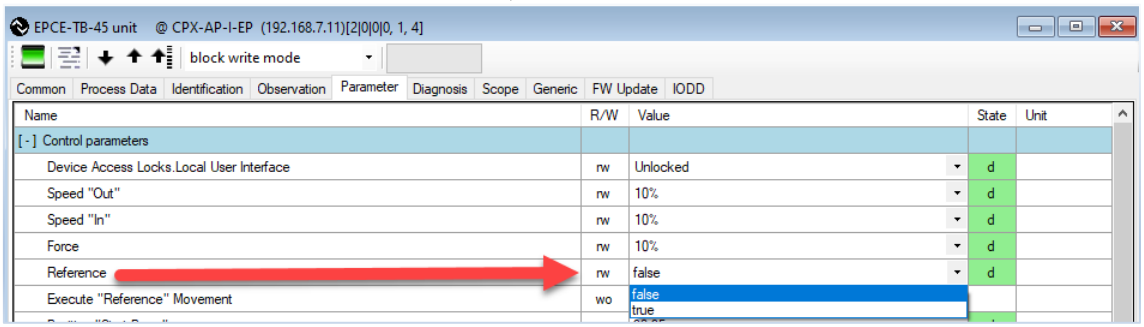
6. To verify that the new FW is downloaded, go to the Identification Tab and read the Firmware Revision.



7. Firmware-update is now done!

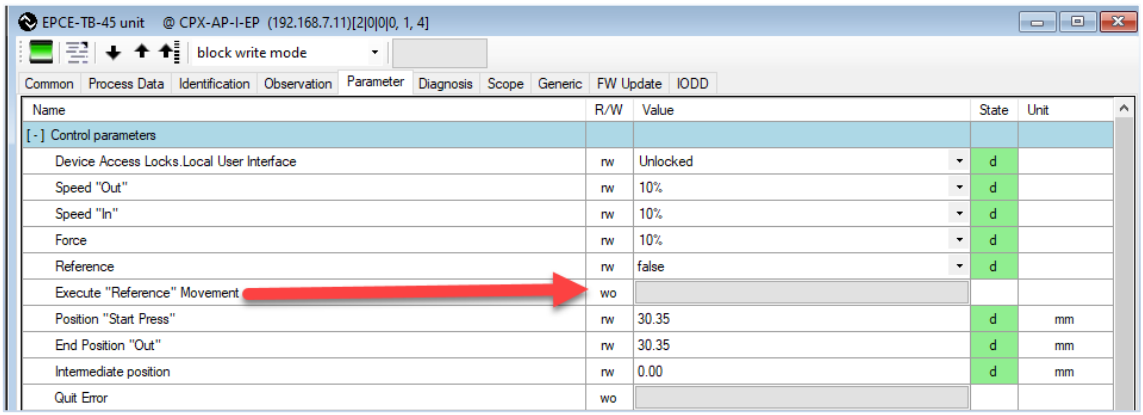
3.7 Re-Reference actuator system (optional)

1. Optional – if necessary:
   Select / change “Reference” end position for reference movement (default = motor side)
   - Select corresponding value at parameter **“Reference”**
     - False = motor side (Rotary = left)
     - True = motor averted (Rotary = right



2. Execute Reference movement via the **Parameter Tab**

   - Press button **“Execute Reference movement”** in corresponding parameter



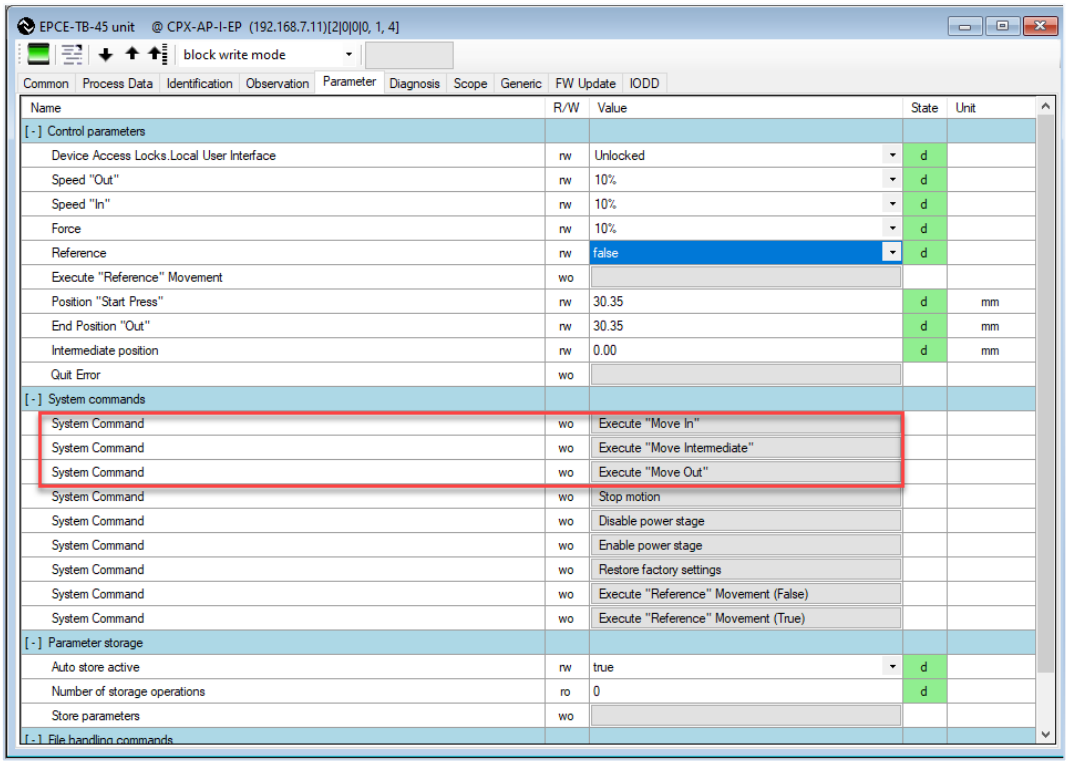
   - Wait for reference movement to be executed and actuator movement stops completely.

   - Actuator will move to both end positions and stops automatically when finished.

➔ **CAUTION**
Actuator will start moving for this process. Watch your fingers!

3. Check functionality of actuator and movement

- by using system commands “Execute Move In” and “Execute Move Out” in System commands



➔ **CAUTION**
Actuator will start moving. Watch your fingers!

- by using process data output
  - Press either Move In or Move Out
  - This will also result in the actuator moving to the In or Out position after the reference is done.

➔ **CAUTION**
Actuator will start moving. Watch your fingers!

4 IO-Link interface description – Main features inside IODD V 1.2.7

4.1 General

➔ **NOTE**
For more detailled information on IO-Link device description please also refer to Application Note “IO-Link Interface Description Simplified Motion Series” (100290) on Festo Support Portal.

Characteristic	Specification
Protocol	IO-Link
Protocol version	Device V1.1 (I-Port & V1.0 not supported)
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	2 bytes
Process data length IN	2 bytes
Process data content OUT	1 Bit (Move "In") 1 Bit (Move "Out") 1 Bit (Quit Error) 1 Bit (Move "Intermediate")
Process data content IN	1 Bit (State "In") 1 Bit (State "Out") 1 Bit (State "Move") 1 Bit (State "Device") 1 Bit (State "Intermediate")
Min. cycle time	1 ms
Data storage required	0,5 kB
Max. current consumption (Logic, IO-Link mode)	150 mA

Table 4.1: General IO-Link Information

4.2 Identification parameters

Index (dec)	Sub-index	Name	Value (example)	Access[1)]			Length (byte)	Format
				U	M	S		
0x0010 (16)	0	Vendor Name	Festo	R	R	R	5	String
0x0011 (17)	0	Vendor Text	http://www.festo.com	R	R	R	20	
0x0012 (18)	0	Product Name	Order code, e.g. EGSS-BS-KF-32-25-8P-ST-M-H1-PLK-AA	R	R	R	max. 64	
0x0013 (19)	0	Product ID	8083801	R	R	R	max. 64	
0x2101 (8449)	0	Part Number	8083801 (= Product ID with Index 0x0013)	R	R	R	max. 64	
0x0014 (20)	0	Product Text	Simplified Motion Series	R	R	R	max. 64	
0x0015 (21)	0	Serial Number	Product Key, e.g. 3S7PL9V6HHM	R	R	R	11	
0x0016 (22)	0	Hardware Revision	REV02	R	R	R	max. 64	
0x0017 (23)	0	Firmware Revision	V16.0.17.87_release	R	R	R	max. 64	
0x43BE (17342)	0	Hardware Identification Key	BOOTLOAD_FW	R	R	R	max. 64	
0x0018 (24)	0	Application Specific Tag	***	R/W	R/W	R/W	max. 32	
0x0019 (25)	0	Function Tag	***	R/W	R/W	R/W	max. 32	
0x001A (26)	0	Location Tag	***	R/W	R/W	R/W	max. 32	

Table 4.2: Identification parameters

4.3 Process Data IN

Bit	15	...	4	3	2	1	0
Process data	not used		ProcessDataVariable (PDV)				
Data content			State"Inter-mediate"	State "De-vice"	State "Move"	State "Out"	State "In"
Index			0x28 (40)				
Sub-Index			5	4	3	2	1
Data type			BooleanT				

Table 4.3: Process Data IN

4.4 Process Data OUT

Bit	15	...	4	3	2	1	0
Process data	not used		ProcessDataVariable (PDV)				
Data content			Move "Inter-mediate"	not used	Quit Error	Move "Out"	Move "In"
Index			0x29 (41)				
Sub-Index			5	...	3	2	1
Data type			BooleanT				

Table 4.4: Process Data OUT

4.5 Device-specific parameters and commands – Acyclic data

Index (dec)	Sub-index	Name	Value / unit / gradient	Access[1)]			Length (byte)	Format
				U	M	S		
Control parameters („Master » Device“)								
0x0100 (256)	0	Speed "In"	1 = 10% (default) … 10 = 100%,	-	R/W	R/W	1	UInteger8
0x0101 (257)	0	Speed "Out"	1 = 10% (default) … 10 = 100%,	-	R/W	R/W	1	UInteger8
0x0102 (258)	0	Force	1 = 10% (default) … 10 = 100%,	-	R/W	R/W	1	UInteger8
0x0103 (259)	0	Reference	linear drive: 0 = motor side, 1 = motor averted rotative drive: 0 = left, 1 = right	-	R/W	R/W	1	BooleanT
0x0104 (260)	0	Exec. "Reference" Movement	0 = no action, 1 = execute command	-	W	W	1	BooleanT
0x0105 (261)	0	Position "Start Press"	linear drive: [mm], 0.01 rotative drive: [°], 0.1	-	R/W	R/W	4	Float32T
0x0106 (262)	0	End Position "Out"	linear drive: [mm], 0.01 rotative drive: [°], 0.1	-	R/W	R/W	4	Float32T
0x0107 (263)	0	Quit Error	0 = no action, 1 = execute command	-	W	W	1	BooleanT
0x0108 (264)	0	Intermediate position	linear drive: [mm], 0.01 rotative drive: [°], 0.1	-	R/W	R/W	4	Float32T
0x0109 (265)	0	Auto store active	0 = not active 1 = active (default)	-	R/W	R/W	1	BooleanT
0x010A (266)	0	Number of storage operations		-	R	R	4	UInteger32
0x010B (267)	0	Store parameters	0 = no action, 1 = execute command	-	W	W	1	BooleanT
0x3000 (12288)	0	Enable file handling	0 = no action (default) 8782 = enable	-	R/W	R/W	2	UInteger16
0x3001 (12289)	0	Execute file handling	0 = no action (default) 5 = overwrite factory settings 272 = execute firmware update	-	R/W	R/W	2	UInteger16

Observation parameters („Device » Master“)								
0x0120 (288)	0	Current position	linear drive: [mm], 0.01 rotative drive: [°], 0.1	R	R	R	4	Integer32
0x0121 (289)	0	Current speed	linear drive: [mm/s], 0.01 rotative drive: [rpm], 1.0	R	R	R	4	Integer32
0x0122 (290)	0	Current force	linear drive: [N], 1.0 rotative drive: [Nm], 0.1	R	R	R	4	Integer32
0x0123 (291)	0	Current temperature	[°C], 1.0	R	R	R	2	Integer16
0x0124 (292)	0	Current electric current	[A], 0.1	R	R	R	4	Integer32
0x0125 (293)	0	Current electric voltage	[V], 0.1	R	R	R	4	Integer32
0x0126 (294)	0	Number of cycles total		R	R	R	4	UInteger32
0x0127 (295)	0	Number of cycles since reset		R	R	R	4	UInteger32
0x0128 (296)	0	Mileage total	linear drive: [km], 0.000001 rotative drive: [r], 0.001	R	R	R	4	UInteger32
0x0129 (297)	0	Mileage since reset	linear drive: [km], 0.000001 rotative drive: [r], 0.001	R	R	R	4	UInteger32
0x012A (298)	0	Reset cycle & mileage	0 = no action, 1 = execute command	W	W	W	1	BooleanT
0x0130 (304)	0	Error code		R	R	R	2	UInteger16

Table 4.5: Device-specific parameters and commands – Acyclic data

4.6 System commands

Value dec	Value hex	Access[1)]			Command	Note	Format
		U	M	S			
200	0xC8	-	W	W	Execute "Move In"	Command for direct execution of movement towards reference end position "Ref" / End position "Lim_{In}"	UInteger8
201	0xC9	-	W	W	Execute "Move Out"	Command for direct execution of movement towards end position "Lim_{Out}"	
202	0xCA	-	W	W	Stop motion	Command for direct execution of standstill. Defend current position	
203	0xCB	-	W	W	Disable power stage	Command for direct execution of torque free standstill. Disable power stage and stay with no torque (NO STO)	
204	0xCC	-	W	W	Enable power stage	Command for enabling power stage and defending current position	
205	0xCD	-	W	W	Restore factory settings	Resets the actuator unit to factory settings	
206	0xCE	-	W	W	Execute "Reference" Movement (False)	Command for setting False (= 0) value for the parameter Reference and for executing "Reference" movement (Detect mechanical end positions)	
207	0xCF	-	W	W	Execute "Reference" Movement (True)	Command for setting True (= 1) value for the parameter Reference and for executing "Reference" movement (Detect mechanical end positions)	
208	0xD0	-	W	W	Execute "Move Intermediate"	Command for direct execution of movement towards intermediate position "Pos_{Imp}"	

Table 4.6: System commands

4.7 Logical combinations for IO-Link process data Move_In, Move_Out, Move_Intermediate

4.7.1 Process Data Out

Move "In"	Move "Out"	Move "Inter."	System Parameter	Note
Start motion				
false	true	false	Execute "MoveOut" 0xC9 - (201)	Start motion to End position "Out"
true	false	false	Execute "MoveIn" 0xC8 - (200)	Start motion to End position "In"
false	false	true	Execute "MoveIntermediate" 0xD0 - (208)	Start motion to Intermediate position
Interrupt motion, Disable power end stage, Quit error				
true	true	false	Disable power stage 0xCB - (203)	- Disable power end stage (after 3 sec) - Quit error
false	true	true		
true	false	true		
true	true	true		

Table 4.7: Logical combinations - Process Data Out

4.7.2 Process Data In

State "In"	State "Out"	State "Inter."	Note
false	false	false	Actuator neither in End position "In", nor End position "Out" nor Intermediate position
true	false	false	Actuator reached End position "In"
false	true	false	Actuator reached End position "Out" or: Actuator reached target force (pressing mode)
false	false	true	Actuator reached Intermediate position
true	true	any	Error

Table 4.8: Logical combinations - Process Data In