# Application Note

FESTO

## IO-Link interface description
## Simplified Motion Series

A brief explanation of the contents:

- identification
- parameters and commands
- process data
- data storage
- diagnosis
- menu structure

Simplified Motion Series:

- (EMCS-ST)
- EGSS-BS
- ELGS-TB/-BS
- ELGE-TB
- ERMS
- EPCS-BS
- EPCE-TB
- ...

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# Table of contents


**1. Technical data** ..... 5
**1.1. General IO-Link specification** ..... 5
**1.2. Communication functions** ..... 5
**2. On-demand data** ..... 6
**2.1. Identification parameters** ..... 6
**2.2. IO-Link standard parameters and commands** ..... 8
**2.3. Device-specific parameters and commands** ..... 9
**3. Process Data** ..... 12
**3.1. Process Data IN** ..... 12
**3.2. Process Data OUT** ..... 12
**4. Data storage** ..... 13
**5. Diagnosis** ..... 14
**6. Menu structure** ..... 16
**7. List of tables** ..... 18


➔ **Note**
All following described parameter are available for firmware version **19.0.4.107** or higher!

For firmware versions 16.0.*.* use the Application Note IO-Link parameter description version 1.10.

Table of contents

# 1 Technical data

## 1.1 General IO-Link specification

| 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<br>Device diagnosis<br>Process data mapping<br>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")<br>1 Bit (Move "Out")<br>1 Bit (Quit Error)<br>1 Bit (Move "Intermediate") |
| Process data content IN | 1 Bit (State "In")<br>1 Bit (State "Out")<br>1 Bit (State "Move")<br>1 Bit (State "Device")<br>1 Bit (State "Intermediate") |
| Min. cycle time | 1 ms |
| Data storage required | 0,5 kB |
| Max. current consumption (Logic, IO-Link mode) | 150 mA |

Tab. 1: General IO-Link specification

### 1.1. **Communication functions**

- Preoperate: Frame type 1_V, OD-capability 8 bytes
- Operate: Frame type 2_V, OD-capability 8 bytes
- SIO-Mode: supported
- ISDU: supported
- Data storage: supported
- Block parameterization: not supported

# 2 On-demand data

## 2.1 Identification parameters

- Vendor-ID: 333 d / 01 4D h
- Device ID: → *Tab. 2*

| Device ID [dec] | Device ID [hex] | Order code |
|---|---|---|
| 600 | 000258 | EMCS-YY-ST (spare part motors) |
| 601 | 000259 | ELGS-TB |
| 602 | 00025A | ELGS-BS |
| 603 | 00025B | EGSS-BS |
| 604 | 00025C | ELGE-TB |
| 605 | 00025D | ERMS |
| 606 | 00025E | EPCS-BS |
| 607 | 00025F | EPCE-BS |
| 608 | 000260 | reserved |
| … | … | |
| 615 | 000267 | |

Tab. 2: Device ID values

| 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 / max. 64 | String |
| 0x0011 (17) | 0 | Vendor Text | http://www.festo.com | R | R | R | 20 / max. 64 | |
| 0x0012 (18) | 0 | Product Name | Order code,<br>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[2)] | 8083801 (same value as Product ID, 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,<br>e.g. 3S7PL9V6HHM | R | R | R | 11 / max. 16 | |
| 0x0016 (22) | 0 | Hardware Revision | e.g.: REV02 | R | R | R | max. 64 | |
| 0x0017 (23) | 0 | Firmware Revision | e.g.: 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 | |

[1] Authorisation group: U = user, M = maintenance, S = specialist; access: R = read, W = write, R/W = read and write, – = no access [2]
Usage of this value is defined by the Festo IO-Link standard

Tab. 3: Identification parameters

## 2.2 IO-Link standard parameters and commands

| Index (dec) | Sub-index | Name | Value | Access[1)] | | | Length (byte) | Format |
|---|---|---|---|---|---|---|---|---|
| | | | | U | M | S | | |
| 0x0002 (2) | 0 | SystemCommand | →Tab. 6: Device-specific commands | - | W | W | 1 | UInterger8 |
| 0x000C (12) | 0..3 | Device Access Locks | bitwise:<br>0 = unlocked,<br>1 = locked | - | - | - | 2 | Record |
| 0x000C (12) | 4 | Lock local user interface | | - | R/W | R/W | 1 | BooleanT |
| 0x0020 (32) | 0 | Error Count | 0 | R | R | R | 2 | UInterger16 |
| 0x0024 (36) | 0 | Device Status | 0 | R | R | R | 1 | UInterger8 |
| 0x0025 (37) | 0 | Detailed Device Status | →Tab. 10: IO-Link events | R | R | R | 18 | Array of 3 byte record items |
| 0x0028 (40) | 0 | ProcessDataInput | →Tab. 7: Mapping the process data | R | R | R | 2 | Record |
| 0x0029 (41) | 0 | ProcessDataOutput | →Tab. 8: Mapping the process data | R/W | R/W | R/W | 2 | Record |

[1)] Authorisation group: U = user, M = maintenance, S = specialist; access: R = read, W = write, R/W = read and write, – = no access

Tab. 4: IO-Link standard parameters and commands

## 2.3 Device-specific parameters and commands

| 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)<br>...<br>10 = 100%, | - | R/W | R/W | 1 | UInteger8 |
| 0x0101 (257) | 0 | Speed "Out" | 1 = 10% (default)<br>...<br>10 = 100%, | - | R/W | R/W | 1 | UInteger8 |
| 0x0102 (258) | 0 | Force | 1 = 10% (default)<br>...<br>10 = 100%, | - | R/W | R/W | 1 | UInteger8 |
| 0x0103 (259) | 0 | Reference | linear drive:<br>0 = motor side,<br>1 = motor averted<br>rotative drive:<br>0 = left,<br>1 = right | - | R/W | R/W | 1 | BooleanT |
| 0x0104 (260) | 0 | Exec. "Reference" Movement (Detect mechanical end positions) | 0 = no action,<br>1 = execute command | - | W | W | 1 | BooleanT |
| 0x0105 (261) | 0 | Position "Start Press" | linear drive:<br>[mm], 0.01<br>rotative drive:<br>[°], 0.1 | - | R/W | R/W | 4 | Float32T |
| 0x0106 (262) | 0 | End Position "Out" | linear drive:<br>[mm], 0.01<br>rotative drive:<br>[°], 0.1 | - | R/W | R/W | 4 | Float32T |
| 0x0107 (263) | 0 | Quit Error | 0 = no action,<br>1 = execute command | - | W | W | 1 | BooleanT |
| 0x0108 (264) | 0 | Intermediate position | linear drive:<br>[mm], 0.01<br>rotative drive:<br>[°], 0.1 | - | R/W | R/W | 4 | Float32T |
| 0x0109 (265) | 0 | Auto store active | 0 = not active<br>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,<br>1 = execute command | - | W | W | 1 | BooleanT |
| 0x3000 (12288) | 0 | Enable file handling | 0 = no action (default)<br>8782 = enable | - | R/W | R/W | 2 | UInteger16 |
| 0x3001 (12289) | 0 | Execute file handling | 0 = no action (default)<br>5 = overwrite factory | - | R/W | R/W | 2 | UInteger16 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | settings<br>272 = execute firmware update | | | | | |
| *Observation parameters („Device ›› Master“)* | | | | | | | | |
| 0x0120 (288) | 0 | Current position | linear drive: [mm], 0.01<br>rotative drive: [°], 0.1 | R | R | R | 4 | Integer32 |
| 0x0121 (289) | 0 | Current speed | linear drive: [mm/s], 0.01<br>rotative drive: [rpm], 1.0 | R | R | R | 4 | Integer32 |
| 0x0122 (290) | 0 | Current force | linear drive: [N], 1.0<br>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<br>rotative drive: [r], 0.001 | R | R | R | 4 | UInteger32 |
| 0x0129 (297) | 0 | Mileage since reset | linear drive: [km], 0.000001<br>rotative drive: [r], 0.001 | R | R | R | 4 | UInteger32 |
| 0x012A (298) | 0 | Reset cycle & mileage | 0 = no action,<br>1 = execute command | W | W | W | 1 | BooleanT |
| 0x0130 (304) | 0 | Error code | | R | R | R | 2 | UInteger16 |

[1)] Authorisation group: U = user, M = maintenance, S = specialist; access: R = read, W = write, R/W = read and write, – = no access

Tab. 5: Device-specific parameters

| 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 "$Pos_{Imp}$" | |

[1)] Authorisation group: U = user, M = maintenance, S = specialist; access: R = read, W = write, R/W = read and write, – = no access

Tab. 6: Device-specific commands, values for index 0x0002.0

# 3 Process Data

## 3.1 Process Data IN

| **Bit** | **15** | **...** | **4** | **3** | **2** | **1** | **0** |
|---|---|---|---|---|---|---|---|
| Process data | not used | | ProcessDataVariable (PDV) | | | | |
| Data content | | | State "Intermediate" | State "Device" | State "Move" | State "Out" | State "In" |
| Index | | | 0x28 (40) | | | | |
| Sub-Index | | | 5 | 4 | 3 | 2 | 1 |
| Data type | | | BooleanT | | | | |

Tab. 7: Mapping the process data IN

## 3.2 Process Data OUT

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

Tab. 8: Mapping the process data OUT

# 4 Data storage

- The Data Storage (DS) mechanism enables the consistent and up-to-date duplication of the device parameters which were defined for supporting this feature. With DS functionality the parameterization of another connected device can be ensured after replacement. Using this method, the IO-Link master receives the DS parameter set of the first device (Device 1) to provide it and will then proceed to write the data one by one to all other connected devices (Device 2 to Device n).
- The list of implemented Data Storage parameters is as follows:

| **Index (dec)** | **Sub-index** | **Access**[1)] | | | **Name** | **Note** | **Format** |
|---|---|---|---|---|---|---|---|
| | | **U** | **M** | **S** | | | |
| 0x0018 (24) | 0 | R/W | R/W | R/W | Application Specific Tag | | String |
| 0x0019 (25) | 0 | R/W | R/W | R/W | Function Tag | | String |
| 0x001A (26) | 0 | R/W | R/W | R/W | Location Tag | | String |
| 0x0100 (256) | 0 | - | R/W | R/W | Speed "In" | | UInteger8 |
| 0x0101 (257) | 0 | - | R/W | R/W | Speed "Out" | | UInteger8 |
| 0x0102 (258) | 0 | - | R/W | R/W | Force | | UInteger8 |
| 0x0103 (259) | 0 | - | R/W | R/W | Reference | | Boolean |
| 0x0105 (261) | 0 | - | R/W | R/W | Position "Start Press" | linear drive:<br>- unit: [mm]<br>- gradient: 0.01<br>rotative drive:<br>- unit: [°]<br>- gradient: 0.1 | Float32 |
| 0x0106 (262) | 0 | - | R/W | R/W | End Position "Out" | | Float32 |
| 0x0108 (264) | 0 | - | R/W | R/W | Intermediate position | | Float32 |
| | | | | | | | |
| | | | | | | Total data size: | 112 B |

[1)] Authorisation group: U = user, M = maintenance, S = specialist; access: R = read, W = write, R/W = read and write, – = no access

Tab. 9: Data storage parameters

- The device IDs of both devices (Device 1 and Device n) must be the same (e.g. “603” for EGSS-BS)
- Please be aware that the value of End Position "Out" of Device 1 may not be greater than the maximum position of the new Device. The maximum position can be set through a reference run. If the new End Position "Out" value is greater, Device n will discard it and keep the previous value.

# 5 Diagnosis

| Event code | Event type | Mode | Device status | Event name |
|---|---|---|---|---|
| 0x1000 | Error | Event appears (disappears) | Failure | General malfunction – unknown error |
| 0x1801 | Error | Event appears (disappears) | Failure | Supply voltage error – Power supply voltage too high |
| 0x1802 | Error | Event appears (disappears) | Failure | Supply voltage error – Power supply voltage too low or not connected |
| 0x1803 | Error | Event appears (disappears) | Failure | Supply voltage error – Logic supply voltage too high |
| 0x1804 | Error | Event appears (disappears) | Failure | Supply voltage error – Logic supply voltage too low |
| 0x1805 | Error | Event appears (disappears) | Failure | Power consumption error – I2t exceeded |
| 0x1806 | Error | Event appears (disappears) | Failure | Voltage error – DC link voltage too low |
| 0x1810 | Error | Event appears (disappears) | Failure | Firmware download error – Firmware package not valid (e.g. checksum error) |
| 0x1811 | Error | Event appears (disappears) | Failure | Firmware download error – Firmware package is not compatible to device and/or hardware |
| 0x1812 | Error | Event appears (disappears) | Failure | Firmware download error – Unknown slot |
| 0x1813 | Error | Event appears (disappears) | Failure | Firmware download error – Empty slot |
| 0x1814 | Error | Event appears (disappears) | Failure | Firmware download error – Firmware update not possible in this state (e.g. power stage is active) |
| 0x1815 | Error | Event appears (disappears) | Failure | Firmware download error – Package currently in use (e.g. by file transfer) |
| 0x1816 | Error | Event appears (disappears) | Failure | Firmware download error – Error initiating firmware update |
| 0x1817 | Error | Event appears (disappears) | Failure | Firmware download error – Error resuming firmware update (e.g. write error in file system) |
| 0x1820 | Error | Event appears (disappears) | Failure | Parameter package download error – Empty slot |
| 0x1821 | Error | Event appears (disappears) | Failure | Parameter package download error – Parameter set not readable (e.g. checksum error) |
| 0x1822 | Error | Event appears (disappears) | Failure | Parameter package download error – Parameter set incompatible |
| 0x1823 | Error | Event appears (disappears) | Failure | Parameter package download error – Parameter not found |
| 0x4000 | Error | Event appears (disappears) | Failure | Temperature fault – Overload |
| 0x4210 | Warning | Event appears (disappears) | Outside the specification | Device temperature overrun – Clear source of heat |
| 0x4220 | Warning | Event appears (disappears) | Outside the specification | Device temperature underrun – Insulate Device |
| 0x8CA0 | Notification | Simple mes- | Device is | Application information – Device not referenced |

| | | | | |
|---|---|---|---|---|
| | | sage | operating properly | |
| 0x8CA1 | Notification | Simple message | Device is operating properly | Application information – Reference running |
| 0x8CA2 | Warning | Event appears (disappears) | Outside the specification | Application warning – Start Press position out of range |
| 0x8CA3 | Warning | Event appears (disappears) | Outside the specification | Application warning – End position out of range |
| 0x8CA4 | Warning | Event appears (disappears) | Outside the specification | Power consumption warning – I2t close to be exceeded |

Tab. 10: IO-Link events

# 6 Menu structure

| **Menu name** | **Access**[1)] | | |
|---|---|---|---|
| | **U** | **M** | **S** |
| Identification | V | V | V |
| Parameters | - | V | V |
| Observation | V | V | V |
| Diagnosis | V | V | V |

[1)] *Authorisation group: U = user, M = maintenance, S = specialist; visibility: V = visible, – = not visible*

Tab. 11: General menu structure

| **Menu** | | **Parameter** | | |
|---|---|---|---|---|
| **Name** | **Group** | **Name** | **Index (dec)** | **Sub-index** |
| Identification | | Vendor Name | 0x0010 (16) | 0 |
| | | Vendor Text | 0x0011 (17) | 0 |
| | | Product Name | 0x0012 (18) | 0 |
| | | Product ID | 0x0013 (19) | 0 |
| | | Part Number | 0x2101 (8449) | 0 |
| | | Product Text | 0x0014 (20) | 0 |
| | | Serial Number | 0x0015 (21) | 0 |
| | | Hardware Revision | 0x0016 (22) | 0 |
| | | Firmware Revision | 0x0017 (23) | 0 |
| | | Hardware Identification Key | 0x43BE (17342) | 0 |
| | | Application Specific Tag | 0x0018 (24) | 0 |
| | | Function Tag | 0x0019 (25) | 0 |
| | | Location Tag | 0x001A (26) | 0 |
| Parameters | Control parameters | Device Access Locks: lock local user interface | 0x000C (12) | 4 |
| | | Speed "In" | 0x0100 (256) | 0 |
| | | Speed "Out" | 0x0101 (257) | 0 |
| | | Force | 0x0102 (258) | 0 |
| | | Reference | 0x0103 (259) | 0 |
| | | Exec. "Reference" Movement | 0x0104 (260) | 0 |
| | | Position "Start Press" | 0x0105 (261) | 0 |
| | | Intermediate position | 0x0108 (264) | 0 |
| | | End Position "Out" | 0x0106 (262) | 0 |
| | | Quit Error | 0x0107 (263) | 0 |
| | System commands | Execute "Move In" | 0x0002 (2), value = 200 | 0 |
| | | Execute "Move Intermediate" | 0x0002 (2), value = 208 | 0 |
| | | Execute "Move Out" | 0x0002 (2), value = 201 | 0 |

| | | | | |
|---|---|---|---|---|
| | | Stop motion | 0x0002 (2), value = 202 | 0 |
| | | Disable power stage | 0x0002 (2), value = 203 | 0 |
| | | Enable power stage | 0x0002 (2), value = 204 | 0 |
| | | Restore factory settings | 0x0002 (2), value = 205 | 0 |
| | | Execute "Reference" Movement (False) | 0x0002 (2), value = 206 | 0 |
| | | Execute "Reference" Movement (True) | 0x0002 (2), value = 207 | 0 |
| | Parameter storage | Auto store active | 0x0109 (265) | 0 |
| | | Number of storage operations | 0x010A (266) | 0 |
| | | Store parameters | 0x010B (267) | 0 |
| | File handling commands | Enable file handling | 0x3000 (12288) | 0 |
| | | Execute file handling | 0x3001 (12289) | 0 |
| Observation | | Current position | 0x0120 (288) | 0 |
| | | Current speed | 0x0121 (289) | 0 |
| | | Current force | 0x0122 (290) | 0 |
| | | Current temperature | 0x0123 (291) | 0 |
| | | Current electric current | 0x0124 (292) | 0 |
| | | Current electric voltage | 0x0125 (293) | 0 |
| | | Number of cycles total | 0x0126 (294) | 0 |
| | | Number of cycles since reset | 0x0127 (295) | 0 |
| | | Mileage total | 0x0128 (296) | 0 |
| | | Mileage since reset | 0x0129 (297) | 0 |
| | | Reset cycle & mileage | 0x012A (298) | 0 |
| Diagnosis | | Error code (display format „hex“) | 0x0130 (304) | 0 |
| | | Error code (display format „dec“) | 0x0130 (304) | 0 |
| | | Error code (display format „bin“) | 0x0130 (304) | 0 |
| | | Error Count | 0x0020 (32) | 0 |
| | | Device Status | 0x0024 (36) | 0 |
| | | Detailed Device Status | 0x0025 (37) | 0 |

Tab. 12: Detailed menu structure

# 7 List of tables

Tab. 1: General IO-Link specification ..... 5
Tab. 2: Device ID values 6
Tab. 3: Identification parameters ..... 7
Tab. 4: IO-Link standard parameters and commands ..... 8
Tab. 5: Device-specific parameters ..... 10
Tab. 6: Device-specific commands, values for index 0x0002.0 ..... 11
Tab. 7: Mapping the process data IN ..... 12
Tab. 8: Mapping the process data OUT ..... 12
Tab. 9: Data storage parameters ..... 13
Tab. 10: IO-Link events 15
Tab. 11: General menu structure ..... 16
Tab. 12: Detailed menu structure ..... 17