

code 80640 Edition 10/2020

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1. INTRODUCTION

WPL magnetostrictive transducer implements IO-Link communication.

IO-Link is a point to point bi-directional communication compliant with IEC 61131-9 standard.

In the same cable and connector both power supply and digital communication are included.

The digital communication allows the transfer of data between the Device (the WPL transducer) and the Master to which the device is connected.

These data are:

- Process data, such as position, speed, digital thresholds
- Acyclic data, as parameterization, statistic, diagnostic data

IO-Link standard provides a descriptor file called IO-Link Device Description (IODD).

This file allows a clear identification of the device and comprehension of data provided and exchanged.

Please refer to Gefran website for the download of IO-Link files.

2. INSTALLATION AND ELECTRICAL CONNECTIONS

2.1. General precautions

The system must be used only in accordance with the required protection level.

The sensor must be protected against accidental knocks and used in accordance with the instrument's ambient characteristics.

The sensors must be powered with non-distributed networks and always at lengths of less than 30 mt.

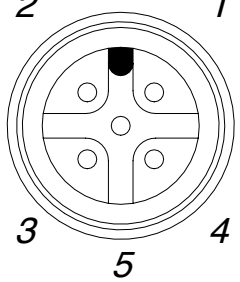
2.2. Electrical installation

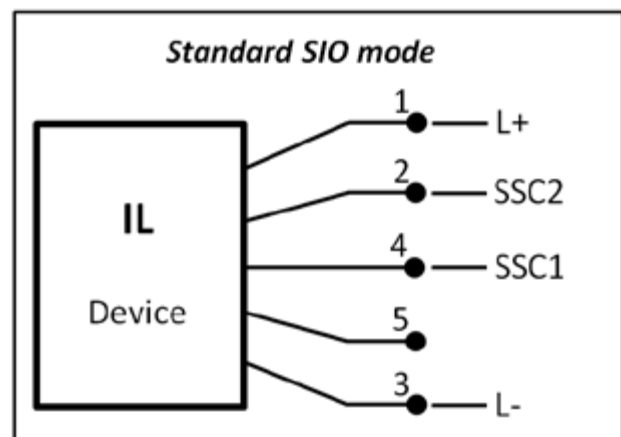
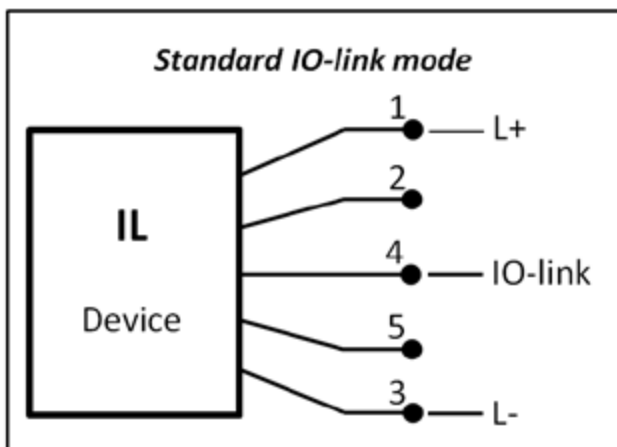
The transducer must be grounded (normally through the machine body or equipment it is installed on).

To prevent interference, separate the power cables from signal cables

The WPL transducer has a male M12 5 pole connector for power supply and output signal. According to the ordering code these are the different connection configurations available, where:

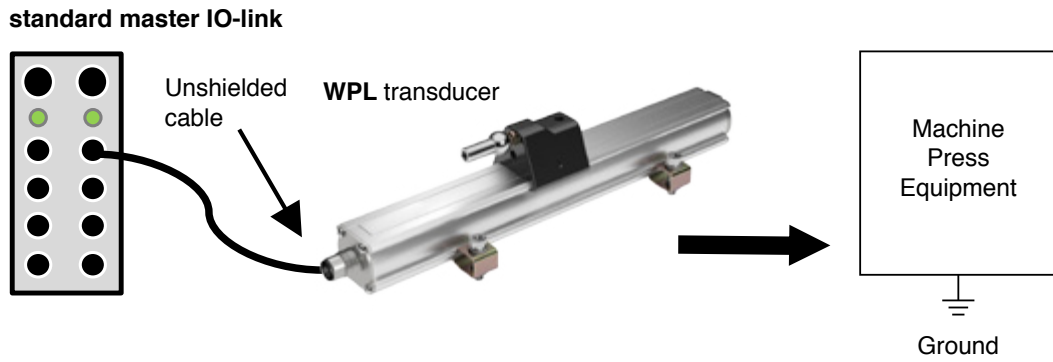
- L+ = Power supply + (nominal 24 Vdc)
- DO = Digital output
- L- = Power supply - (0 Vdc)
- IO-Link = Digital communication pin
- SSC1/2 = Switching signal channel 1 and 2 (output current limit = 200mA), active only in SIO mode

5 pin M12X1 connector	5 pin M12X1 connector	IO-Link Output
	1	V+
	2	DO (*)
	3	V-
	4	IO-Link
	5	N.C.



Notes:

- Connect the transducer to a standard IO-Link master through a standard unshielded M12 cable (max length 20m according to IO-Link specification)



3. COMMAND MODES

3.1. IO-Link Information

Port Class	A
Baud rate	COM3 (230.4 kbit/s)
IO-Link version (1)	1.1
Profile	Generic Smart Sensor
Process data input type / length (2)	Type A (Position): 4 bytes Type B (Position + SSCn): 4 bytes Type C (Speed + Position): 6 bytes Type D (Speed + Position + SSCn): 6 bytes
Process data output length	0
Min Cycle Time	1ms
SIO mode	Supported
ISDU	Supported
Data storage	Supported

(1) Compliant to IO-Link Interface specification v.1.1.2 (Jul13)

(2) PDI type depends on the ordering code of the product

3.2. SIO mode and IO-Link mode

The device supports both SIO mode and IO-Link mode.

In SIO mode the transducer behaves like a digital sensor: on pin 4 and 2 of M12 connector two digital thresholds are available and programmable (replicating the same behavior configured for SSCs).

In IO-Link mode the transducer communicates with a standard IO-Link master on pin 4 of M12 connector.

3.3. Process Data mapping

The device offers four possible mappings of Process Data Input, according to ordering code.

Note: Different mapping leads to different IOdds, please refer to Gefran website for the download of proper IOdd.

PDI Mapping “Type A”

Position (32 bit)

31..0	
Position	

PDI Mapping “Type B”

Position (30 bit) + SSCn (2 bit)

31..2	1	0
Position	SSC2	SSC1

PDI Mapping “Type C”

Speed (16 bit) + Position (32 bit)

47..32	31..0
Speed	Position

PDI Mapping “Type D”

Speed (16 bit) + Position (30 bit) + SSCn (2 bit)

47..32	31..2	1	0
Speed	Position	SSC2	SSC1

Where:

- Speed is the measured value of speed given in 0.5 mm/s
- Position is the measured value of position given in 1 um
- SSC1: Switching Signal Channel 1 is an on/off bit changing its value according to the exceeding of position threshold(s) programmed by the user, using different programmable logics for the comparison
- SSC2: Switching Signal Channel 2 is an on/off bit changing its value according to the exceeding of position threshold(s) programmed by the user, using different programmable logics for the comparison

3.4. Parameterization data WPL

This paragraph includes list and explanation of relevant available parameters for WPL transducer, listed according to IO-Link specification

• Predefined parameters - System

Index	Subindex	Object name	Access			Length	Data Type	Value (example)	Description
			U	M	S				
0x0002	0x00	System Command	W	W	W	1	UInt8	See table below	

Table 1 System command values-

Value	Access			Command	Data Type	Description
	U	M	S			
0x01	W	W	W	ParamUploadStart	UInt8	
0x02	W	W	W	ParamUploadEnd	UInt8	
0x03	W	W	W	ParamDownloadStart	UInt8	
0x04	W	W	W	ParamDownloadEnd	UInt8	
0x05	W	W	W	ParamDownloadStore	UInt8	
0x06	W	W	W	ParamBreak	UInt8	
0x41	-	W	W	TeachSP1	UInt8	It allows to teach "Setpoint 1" (SP1) for the selected Switching Signal Channel(s). SP1 is defined by one "TeachPoint" ("Single value teach-in" mode)
0x42	-	W	W	TeachSP2	UInt8	It allows to teach "Setpoint 2" (SP2) for the selected Switching Signal Channel(s). SP2 is defined by one "TeachPoint" ("Single value teach-in" mode)
0X82	-	W	W	RestoreFactorySettings	UInt8	Restore the default settings stored during factory calibration
0xA0	-	W	W	TeachZeroOffset	UInt8	Sets the zero offset of position so that the current measured value is zero
0xA1	-	W	W	TeachStartPosition	UInt8	Sets the initial value of the monitoring range area for the position data
0xA2	-	W	W	TeachEndPosition	UInt8	Sets the final value of the monitoring range area for the position data
0xA3	-	W	W	ResetOperatingTimeCounters	UInt8	Reset the value of the following parameters: • OperatingTimeCounter • OperatingTimeInMovementCounter
0xA4	-	W	W	ResetSpeedMax	UInt8	Reset the value of the following parameter: • SpeedMax
0xA5	-	W	W	ResetSpeedMaxPeaksCounter	UInt8	Reset the value of the following parameter: • SpeedMaxPeaksCounter
0xA6	-	W	W	ResetAccelerationMax	UInt8	Reset the value of the following parameter: • AccelerationMax
0xA7	-	W	W	ResetAccelerationMaxPeaksCounter	UInt8	Reset the value of the following parameter: • AccelerationMaxPeaksCounter
0xA8	-	W	W	ResetDistanceKm	UInt8	Reset the value of the following parameter: • DistanceKm
0xA9	-	W	W	ResetOutOfMonitoringRangeCounter	UInt8	Reset the value of the following parameter: • OutOfMonitoringRangeCounter
0xAA	-	W	W	ResetOutOfMeasurementRangeCounter	UInt8	Reset the value of the following parameter: • ResetOutOfMeasurementRangeCounter
0xAB	-	W	W	ResetTemperatureMax	UInt8	Reset the value of the following parameter: • TemperatureMax
0xAC	-	W	W	ResetTemperatureMaxPeaksCounter	UInt8	Reset the value of the following parameter: • TemperatureMaxPeaksCounter
0xFA	-	W	W	StoreStatisticsData	UInt8	Store the actual values of the Statistics Data: • OperatingTimeCounter • OperatingTimeInMovementCounter • DistanceKM • TemperatureMax • TemperatureMaxPeaksCounter • SpeedMax • SpeedMaxPeaksCounter • AccelerationMax • AccelerationMaxPeaksCounter • OutOfMonitoringRangeCounter • OutOfMeasurementRangeCounter Note: Statistics Data are automatically saved every 6 minutes
0xFB	-	W	W	EventError_36349_appear	UInt8	Command to test event error appear (36349)
0xFC	-	W	W	EventError_36349_disappear	UInt8	Command to test event error disappear (36349)
0xFD	-	W	W	EventWarning_36350_appear	UInt8	Command to test event warning appear (36350)
0xFE	-	W	W	EventWarning_36350_disappear	UInt8	Command to test event warning disappear (36350)
0xFF	-	W	W	EventNotification_36351_singleshot	UInt8	Command to test event notification (36351)

System command values

U=User, M=Maintenance, S=Specialist, - : command not available

• **Predefined parameters – Identification**

Index	Sub Index	Object name	Access			Length	Data Type	Value (example)	Description
			U	M	S				
0x0010	0x00	VendorName	RO	RO	RO	10	String	GEFRAN spa	
0x0011	0x00	VendorText	RO	RO	RO	14	String	www.gefran.com	
0x0012	0x00	ProductName	RO	RO	RO	Max64	String	WPL-A-0300-D 0000X000X00X0XX	Full description of product
0x0013	0x00	ProductID	RO	RO	RO	12	String	WxL-A-xxxx-D	Model type
0x0014	0x00	ProductText	RO	RO	RO	Max43	String	GEFRAN Magnetostrictive Position Transducers	User friendly description of the product
0x0015	0x00	SerialNumber	RO	RO	RO	8	String	20400102	Unique serial number for the product
0x0016	0x00	HardwareRevision	RO	RO	RO	3	String	1.0	
0x0017	0x00	FirmwareRevision	RO	RO	RO	3	String	1.0	
0x0018	0x00	ApplicationSpecificTag	RO	RW	RW	Max32	String	*** (Default)	User specifies a tag which defines functionality, position of the transducer in the system
0x0019	0x00	FunctionTag	RO	RW	RW	Max32	String	Empty (Default)	User specifies a tag which defines functionality, position of the transducer in the system
0x001A	0x00	LocationTag	RO	RW	RW	Max32	String	Empty (Default)	User specifies a tag which defines functionality, position of the transducer in the system

U=User, M=Maintenance, S=Specialist

• **Predefined parameters – Diagnosis**

Index	Sub Index	Object name	Access			Length	Data Type	Value (example)	Description
			U	M	S				
0x0020	0x00	ErrorCount	RO	RO	RO	2	UInt16	0	Incremental counter of errors since power-on
0x0024	0x00	DeviceStatus	RO	RO	RO	1	UInt8	See table below	Defines the status of the device
0x0025	0x01 0x02 0x03 0x04	DetailedDeviceStatus	RO	RO	RO	Variable	(Array of 3 bytes Record)	See table below	Specifies the detailed status of the device. Octet 1: EventQualifier Octet 2, 3: EventCode
0x0028	0x00	ProcessDataInput	RO	RO	RO	PD length	PD	0	Read last valid Process Data from PDIn channel

• **Device Status Values**

Value	Description
0x00	Device is operating properly (no errors/warnings)
0x01	Maintenance required
0x02	Out of specification
0x03	Functional check
0x04	Failure

• **Errors and warnings in Detailed Device Status**

Event Code	Event Description	Event Type	Device Status	Possible Failure	Process Data Value	Reset Condition
0x8CA3	Position above monitoring range	Warning	Maintenance required	Position value is higher than the upper value of the monitoring range area defined by the user	not changed	Keep the cursor position below the higher threshold, or change threshold value
0x8CA4	Position below monitoring range	Warning	Maintenance required	Position value is lower than the lower value of the monitoring range area defined by the user	not changed	Keep the cursor position above the lower threshold, or change threshold value
0x8CA5	Temperature above peak threshold	Warning	Maintenance required	Measured temperature is higher than the peak threshold defined by the user	not changed	Lower the working temperature of the device, or increase threshold value
0x8C10	Process variable range overrun	Warning	Out of specification	Detected position of the magnet is above the calibration full-scale point	not changed	Keep the cursor position inside the working area defined by the manufacturer
0x8C20	Measurement range exceeded	Warning	Out of specification	No magnet detected by the sensor	Position Data: • 0x7FFFFFFF for PDI mapping "Type A" and "Type C" (without SSCs) • 0x1FFFFFFF for PDI mapping "Type B" and "Type D" (with SSCs) Speed Data: 0x7FFF	Position the magnet over the sensor, inside the working area defined by the manufacturer

Event Code	Event Description	Event Type	Device Status	Possible Failure	Process Data Value	Reset Condition
0x8C30	Process variable range underrun	Warning	Out of specification	Detected position of the magnet is below the calibration zero point	not changed	Keep the cursor position inside the working area defined by the manufacturer
0x4210	Device temperature overrun	Warning	Out of specification	Detected temperature of the device electronics is over specification limit	not changed	Increase thermal dissipation of the device
0x8CA1	More than one magnet	Warning	Out of specification	More than one magnet detected by the sensor	Position Data: • 0x7FFFFFFF for PDI mapping "Type A" and "Type C" (without SSCs) • 0x1FFFFFFF for PDI mapping "Type B" and "Type D" (with SSCs) Speed Data: 0x7FFF	Remove exceeding magnets from the sensor
0x8CA6	Speed over peak threshold	Warning	Maintenance required	Detected speed is over the peak value set by the user	not changed	Reduce speed or increase threshold value
0x8CA7	Acceleration over peak threshold	Warning	Maintenance required	Detected acceleration is over the peak value set by the user	not changed	Reduce acceleration or increase threshold value

• Error Codes

Error Code	Description
0x8000	Device application error – no details
0x8011	Index not available
0x8012	Sub-index not available
0x8022	Service not available – Device control
0x8023	Access denied
0x8030	Parameter value out of range
0x8031	Parameter value above limit
0x8032	Parameter value below limit
0x8033	Parameter length overrun
0x8034	Parameter length underrun
0x8035	Function not available
0x8036	Invalid parameter set
0x8040	Inconsistent parameter set
0x8041	Inconsistent parameter set

Regarding Detailed Device Status: When an event appears, this event is placed in the first free subscription available. When an event disappears, that position becomes again free. When an event is active, it does not change its position when other positions become free, or when a new event appears. If an active event disappears and then reappears, the new position can be different from the previous one (the first available, as said). A maximum of four events can be recorded in the buffer. Exceeding events are not registered in the buffer (anyway, event messages are always sent).

• Predefined parameters – Profile specific parameters

Index	Sub Index	Object Name	Access			Length	Data Type	VALUE (example)	Value Range	Gradient	Offset	Unit	Description
			U	M	S								
0x003A	0x00	TeachInSelect	-	R/W	R/W	1	UInt8	0x00: SSC1 (default) 0x01: SSC1 0x02: SSC2	0...2	-	-	-	Defines the channel to which address teach-in
0x003B	0x00	TeachIn Result	-	RO	RO	1	Record						Show the result of teach-in procedure
	0x01	State	-	RO	RO	4 bit	UInt4	0 See Table 11	0...15	-	-	-	
	0x02	FlagSP1TP1	-	RO	RO	1 bit	Boolean	0: SP1TP1 not taught 1...255: SP1TP1 taught	0...255	-	-	-	
	0x03	FlagSP1TP2	-	RO	RO	1 bit	Boolean	0: SP1TP2 not taught 1...255: SP1TP2 taught	0...255	-	-	-	
	0x04	FlagSP2TP1	-	RO	RO	1 bit	Boolean	0: SP2TP1 not taught 1...255: SP2TP1 taught	0...255	-	-	-	
	0x05	FlagSP2TP2	-	RO	RO	1 bit	Boolean	0: SP2TP2 not taught 1...255: SP2TP2 taught	0...255	-	-	-	
0x003C	0x00	SSC1Param	RO	R/W	R/W	8	Record						Defines the switch-points of Channel 1

Index	Sub Index	Object Name	Access			Length	Data Type	VALUE (example)	Value Range	Gradient	Offset	Unit	Description
			U	M	S								
	0x01	SP1	RO	R/W	R/W	4	Int32	FS (default)	-536870912..536870911	1	0	um	
	0x02	SP2	RO	R/W	R/W	4	Int32	0 (default)	-536870912..536870911	1	0	um	
0x003D	0x00	SSC1Config	RO	R/W	R/W	6	Record						Defines the configuration of Channel 1
	0x01	Logic	RO	R/W	R/W	1	UInt8	0x00: High active (default) 0x01: Low active	0...1	-	-	-	
	0x02	Mode	RO	R/W	R/W	1	UInt8	0x00: Deactivated (default) 0x01: Single point 0x02: Window 0x03: Two point	0...3	-	-	-	
	0x03	Hyst	RO	R/W	R/W	4	Int32	0x0000: no hysteresis Other values: hysteresis in um	0...10%FS	1	0	um	
0x003E	0x00	SSC2Param	RO	R/W	R/W	8	Record						Defines the switch-points of Channel 2
	0x01	SP1	RO	R/W	R/W	4	Int32	FS (default)	-536870912..536870911	1	0	um	
	0x02	SP2	RO	R/W	R/W	4	Int32	0 (default)	-536870912..536870911	1	0	um	
0x003F	0x00	SSC2Config	RO	R/W	R/W	4	Record						Defines the configuration of Channel 2
	0x01	Logic	RO	R/W	R/W	1	UInt8	0x00: High active (default) 0x01: Low active	0...1	-	-	-	
	0x02	Mode	RO	R/W	R/W	1	UInt8	0x00: Deactivated (default) 0x01: Single point 0x02: Window 0x03: Two point	0...3	-	-	-	
	0x03	Hyst	RO	R/W	R/W	4	Int32	0x00000000: no hysteresis (default) Other values: hysteresis in um unit	0...10%FS	1	0	um	

• **Teach-in state**

Error Code	Description
0	IDLE
1	Set point 1 OK
2	Set point 2 OK
3	Set point 1 and 2 OK
4	WAIT
5	BUSY
7	ERROR

• **Device Parameters – Preferred indices**

Index	Sub Index	Object Name	Access			Length	Data Type	VALUE (example)	Value Range	Gradient	Offset	Unit	Description
			U	M	S								
0x0070	0x00	ZeroOffset	RO	R/W	R/W	4	Int32	0 (default)	-536870912..536870911	1	0	um	Actual zero offset value
0x0071	0x00	Resolution	RO	R/W	R/W	1	UInt8	5	5, 10, 20, 50, 100	1	0	um	Resolution of position data
0x0072	0x00	FilterConstant	RO	R/W	R/W	1	UInt8	0: no filter (default)	0, 2, 4, 8	-	-	-	Filter Constant for position filtering
0x0073	0x00	MeasurementDirection	RO	R/W	R/W	1	Boolean	0: forward (default) 1..255: backward	0...255	-	-	-	Direction for increasing measure. Forward: from the electronics housing to profile/rod end. Backward: from profile/rod end to electronics housing
0x0074	0x00	MonitoringRange-StartPosition	RO	R/W	R/W	4	Int32	0 (default)	-536870912..536870911	1	0	um	Start point of position monitoring range

Index	Sub Index	Object Name	Access			Length	Data Type	VALUE (example)	Value Range	Gradient	Offset	Unit	Description
			U	M	S								
0x0075	0x00	MonitoringRangeEndPosition	RO	R/W	R/W	4	Int32	FS (default)	-536870912..536870911	1	0	um	End point of position monitoring range
0x0082	0x00	SSC1SetDelay	RO	R/W	R/W	2	UInt16	0 (default)	0..500	0.1	0	s	SSC1 Delay time set
0x0083	0x00	SSC1ResetDelay	RO	R/W	R/W	2	UInt16	0 (default)	0..500	0.1	0	s	SSC1 Delay time reset
0x0084	0x00	SSC2SetDelay	RO	R/W	R/W	2	UInt16	0 (default)	0..500	0.1	0	s	SSC2 Delay time set
0x0085	0x00	SSC2ResetDelay	RO	R/W	R/W	2	UInt16	0 (default)	0..500	0.1	0	s	SSC2 Delay time reset
0x0096	0x00	NominalSpan	RO	RO	RO	4	UInt32	FS	0..4000000	1	0	um	Nominal span of the device
0x0097	0x00	SpecialExecutionTag	RO	RO	RO	16	String	XL123	-	-	-	-	String for special execution versions
0x0098	0x00	CalibrationDate	RO	RO	RO	8	String	20200608	-	-	-	-	Calibration date (yyyymmdd)
0x0099	0x00	LinearityError	RO	RO	RO	4	UInt32	2	0..4294967295	0.01	0	%	Linearity error at factory in %FS
0x00A0	0x00	OperatingTimeCounter	RO	RO	RO	4	UInt32	0	0..4294967295	0.1	0	h	Operating hours from first power on
0x00A1	0x00	OperatingTimeInMovementCounter	RO	RO	RO	4	UInt32	0	0..4294967295	0.1	0	h	Operating hours from first power on when speed > 5mm/s
0xAA	0x00	SpeedMax	RO	RO	RO	2	Int16	0	-32768..32767	0.5	0	mm/s	Maximum speed registered
0xAB	0x00	SpeedMaxPeaksCounter	RO	RO	RO	4	UInt32	0	0..4294967295	-	-	-	Counter of maximum speed over threshold
0xAC	0x00	SpeedMaxPeaksCounterThreshold	RO	R/W	R/W	2	UInt16	0	0..65535	0.5	0	mm/s	Threshold of maximum speed counter
0xAD	0x00	AccelerationMax	RO	RO	RO	4	Int32	0	-2147483648..2147483647	0.0005	0	m/s ²	Maximum acceleration registered
0xAE	0x00	AccelerationMaxPeaksCounter	RO	RO	RO	4	UInt32	0	0..4294967295	-	-	-	Counter of maximum acceleration over threshold
0xAF	0x00	AccelerationMaxPeaksCounterThreshold	RO	R/W	R/W	4	UInt32	0	0..4294967295	0.0005	0	m/s ²	Threshold of maximum acceleration
0xB0	0x00	CursorDistance	RO	RO	RO	4	UInt32	0	0..4294967295	1	0	km	Distance covered by magnet
0xB1	0x00	OutOfMonitoringRangeCounter	RO	RO	RO	4	UInt32	0	0..4294967295	-	-	-	Counter of how many times the cursor goes out the monitoring range area
0xB2	0x00	OutOfMeasurementRangeCounter	RO	RO	RO	4	UInt32	0	0..4294967295	-	-	-	Counter of how many times the cursor goes out the measurement range area
0xB4	0x00	Temperature	RO	RO	RO	2	Int16	0	32768..32767	1	0	°C	Measured temperature of electronics
0xB5	0x00	TemperatureMax	RO	RO	RO	2	Int16	0	32768..32767	1	0	°C	Maximum temperature of electronics registered
0xB6	0x00	TemperatureMaxPeaksCounter	RO	RO	RO	4	UInt32	0	0..4294967295	-	-	-	Counter of temperature over threshold
0xB7	0x00	TemperatureMaxPeaksCounterThreshold	RO	R/W	R/W	2	Int16	0	32768..32767	1	0	°C	Threshold of temperature max peaks counter

U=User, M=Maintenance, S=Specialist

3.5. Data Storage

The Data Storage functionality enables to save a predefined group of parameters of an IO-Link device inside the master configuration.

It is also possible to load from the master (write to the device) a previously saved configuration of parameters.

The following table lists the parameters of the device included in the data storage functionality.

Index	Sub-index	Parameter Name
0x003C	0x00	SSC1Param

Index	Sub-index	Parameter Name
0x003D	0x00	SSC1Config
0x003E	0x00	SSC2Param
0x003F	0x00	SSC2Config
0x0071	0x00	Resolution
0x0072	0x00	FilterConstant
0x0073	0x00	MeasurementDirection
0x0074	0x00	MonitoringRangeStartPosition
0x0075	0x00	MonitoringRangeEndPosition
0x0076	0x00	SSC1SetDelay
0x0077	0x00	SSC1ResetDelay
0x0078	0x00	SSC2SetDelay
0x0079	0x00	SSC2ResetDelay
0x00AC	0x00	SpeedMaxPeaksCounterThreshold
0x00AF	0x00	AccelerationMaxPeaksCounterThreshold
0x00B7	0x00	TemperatureMaxPeaksCounterThreshold

3.6. Switching Signal Channels (SSCs) configuration

With PDI mapping "Type B" (Position + SSCn) and "Type D" (Speed + Position + SSCn), the device offers two digital outputs (SSC1 and SSC2):

- Logical, inside process data (bit 0 and bit 1), during IO-Link mode communication
- Physical, on pin 4 (SSC1) and pin 2 (SSC2) of M12 connector, during SIO mode

Independently from the PDI configuration, the device always offers the digital output SSC2:

- Physical, on pin 2 (SSC2) of M12 connector, during IO-Link mode mode

SSCs commute according to the overtaking (high or low) of threshold values based on the position data inside process data.

Logical and physical SSCs behave in the same way, according to different configuration possibilities.

Each channel has its own set of parameters:

- SP1: point of switch HIGH, defined in μm . It must be higher than SP2
- SP2: point of switch LOW, defined in μm . It must be lower than SP1
- LOGIC:
 - High active
 - Low active
- MODE:
 - Deactivated: SSC is not enabled
 - Single Point: only SP1 is used to determine the commutation of SSC (it's important to set Hysteresis)
 - Two Point: SP1 and SP2 are used to determine commutation and contemporarily the hysteresis (no need to set parameter Hyst)
 - Window: SSC commutes both during ramp up and ramp down, when position overtakes SP2 and SP1 threshold in both directions
- HYST: the hysteresis, always expressed in μm , is useful for:
 - Single Point Mode: hysteresis value is all below SP
 - Window Mode: hysteresis value is half above SP, half below SP
- SET_DELAY: filter on SSC activation. If the position movement is faster than the time interval defined in set_delay parameter (0.1s resolution) the SSC does non activate
- RESET_DELAY: filter on SSC deactivation. If the position movement is faster than the time interval defined in set_delay parameter (0.1s resolution) the SSC does non deactivate

For better understanding of SSCs configurations see the following figures:

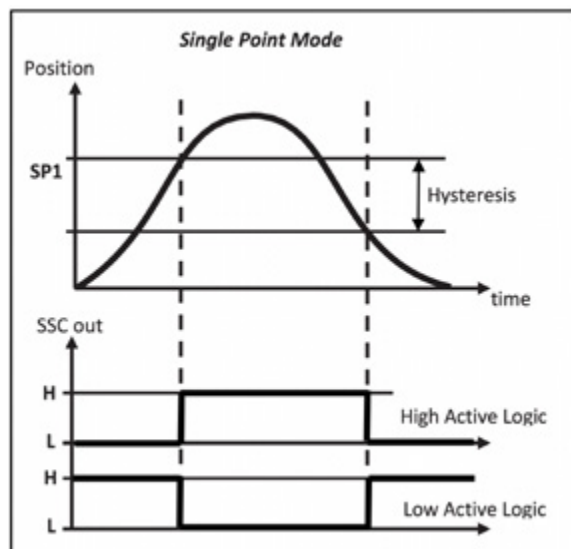


Figure 1 Single Point Mode

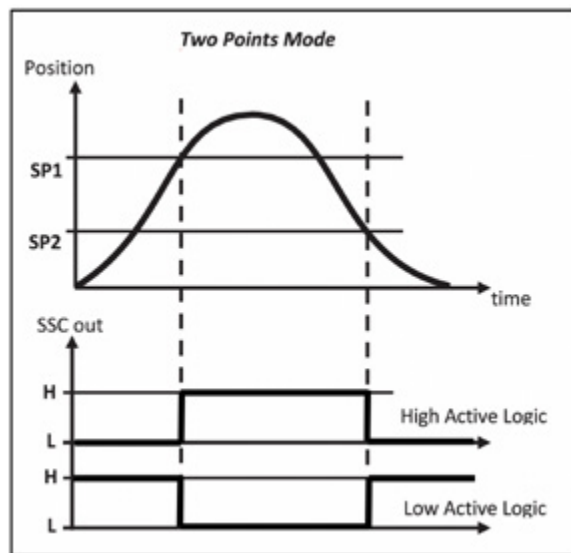


Figure 2 Two Points Mode

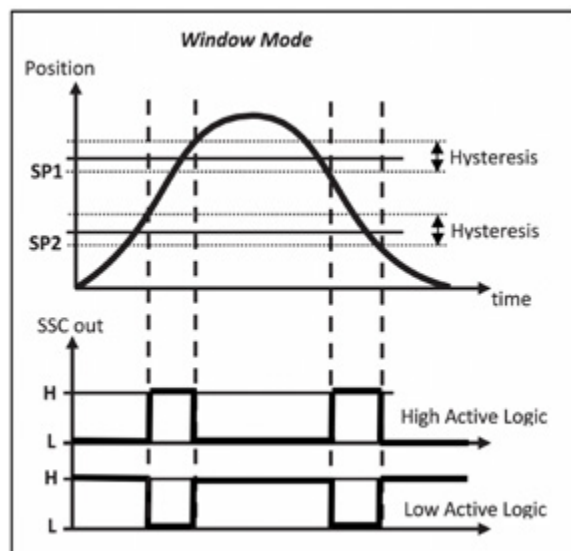


Figure 3 Window Mode

SP1 and SP2 points can be set in two ways:

1. Through direct setting of the value of these objects:

- SSC1Param.SP1 (Index 0x003C, sub-index 1)
- SSC1Param.SP2 (Index 0x003C, sub-index 2)
- SSC2Param.SP1 (Index 0x003E, sub-index 1)
- SSC2Param.SP2 (Index 0x003E, sub-index 2)

2. Through Teach-in procedure applied to SSC1, to SSC2 or both SSC1 and SSC2, using system command 0x41 (TeachSP1) and 0x42 (Teach SP2). SSC1 is the default channel set for the Teach-in procedure

The Teach-in procedure is the following:

1. Select the SSC number (1/2/all) to which address SPs through TeachInChannel (index 0x003A)
2. Move the cursor to the desired position for SP1
3. Launch System Command TeachSP1 (0x41) for setting SP1 value
4. Move the cursor to the desired position for SP2 (SP2 < Sp1)
5. Launch System Command TeachSP2 (0x42) for setting SP2 value

Repeat the procedure for SSC2, if needed.