GEFRAN

LM-L

Contactless linear position transducer with TWIIST technology (IO-Link output)

Cod. 80720 Edit.09/2022 - ENG

REVISION HISTORY

Rev 0	31-03-2022	First release

SUMMARY

1. INTRODUCTION

The Gefran LM-L is a digital multivariable position sensor with IO-Link interface.

IO-Link is a point-to-point bidirectional 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 LM-L transducer) and the Master to which the device is the connected.

These data are:

- Process data:
  - Linear position of channel 1 and digital thresholds
- Acyclic data:
  - Linear position of channel 1 and 2 (Index 0xD0 and index 0xCE)
  - Linear speed of channel 1 and 2 (Index 0xD1 and index 0xCF)
  - Pitch, roll and yaw (Index 0xD2, 0xD3 and index 0xD4)
  - Quaternion scalar part W, X, Y and Z (Index 0xD5, 0xD6, 0xD7 and index 0xD8)
  - Gravity X, Y and Z (Index 0xD9, 0xDA and index 0xDB)
  - Linear acceleration X, Y and Z (Index 0xDC, 0xDD and index 0xDE)
  - Parameterization
  - Statistic data
  - Diagnostic data

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

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 IODD file.

1.1. Working principle

1.1.1. Position and speed measurement

Gefran LM-L sensor exploits the patented TWIIST technology. The main components of this technology are the helical magnet and the triaxial Hall effect IC, as shown in Figure 1: the helical magnet, that composes the magnetic core, and the triaxial Hall effect IC, included in the sensor rod.

From the mathematical description of the helix, a unique pair of magnetic field values Bx, Bz is identified for each measurement position. The arctangent of the ratio between Bx and Bz identifies the rotation angle of the helix, corresponding to the measured position p.

A speed estimation algorithm, based on the discrete derivative of the position with respect to the sampling time, is embedded in the sensor firmware without requiring any computational contribution to the user control unit.

As described in Figure 2, the Gefran LM-L sensor is proposed in half-redundant architecture which allows to obtain two independent position measurements. Therefore, the block diagram of the sensor includes two independent Hall-effect primary elements that share the same electronic board, microcontroller, bus transceiver, and power management circuit.

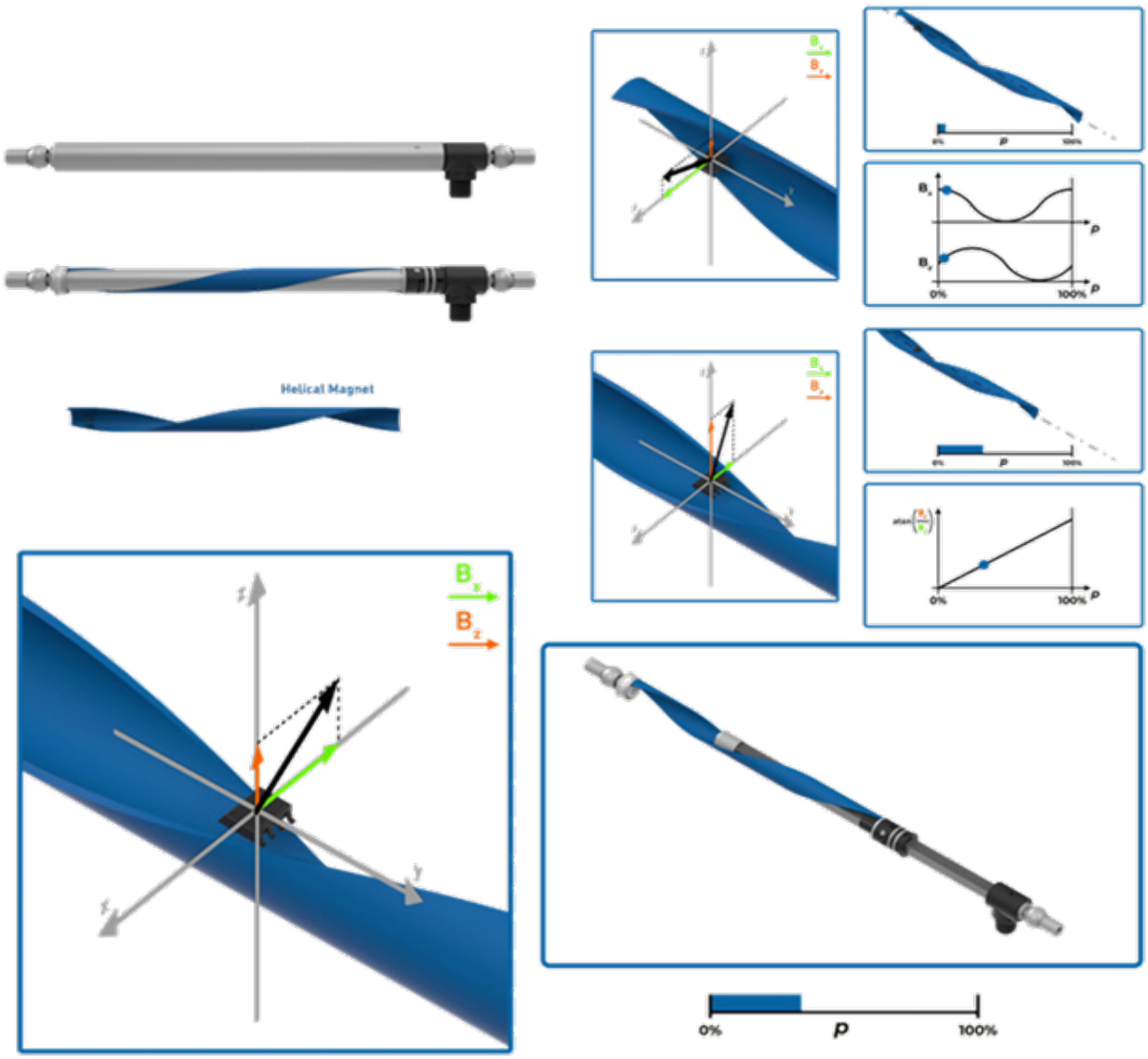


Figure 1. Working principle of position measurement

In Figure 3 an example of position measurement performed with the Gefran LM-L sensor is presented.

The sensor is fixed at both ends to the process to be measured. It does not matter which end moves and which one remains fixed. The sensor will detect the sliding of the magnetic core on the rod, connected at the end with the electrical connection, as an absolute position measurement. The magnetic core can slide on the sensor rod for a length equal to the stroke (FS).

For safety reasons about 1.5 mm of overtravel have been included. Below the ZERO position (0 mm), the sensor will provide negative measurement values up to -1 mm, position that triggers a warning. Similarly, above FS the sensor will provide positive measurement values up to FS + 1 mm, position that triggers a warning.

In order not to irreparably damage the sensor, please do not move the cursor beyond the overtravel thresholds.

Position measurements can be low pass filtered by using a moving average filter by selecting the filter tap.

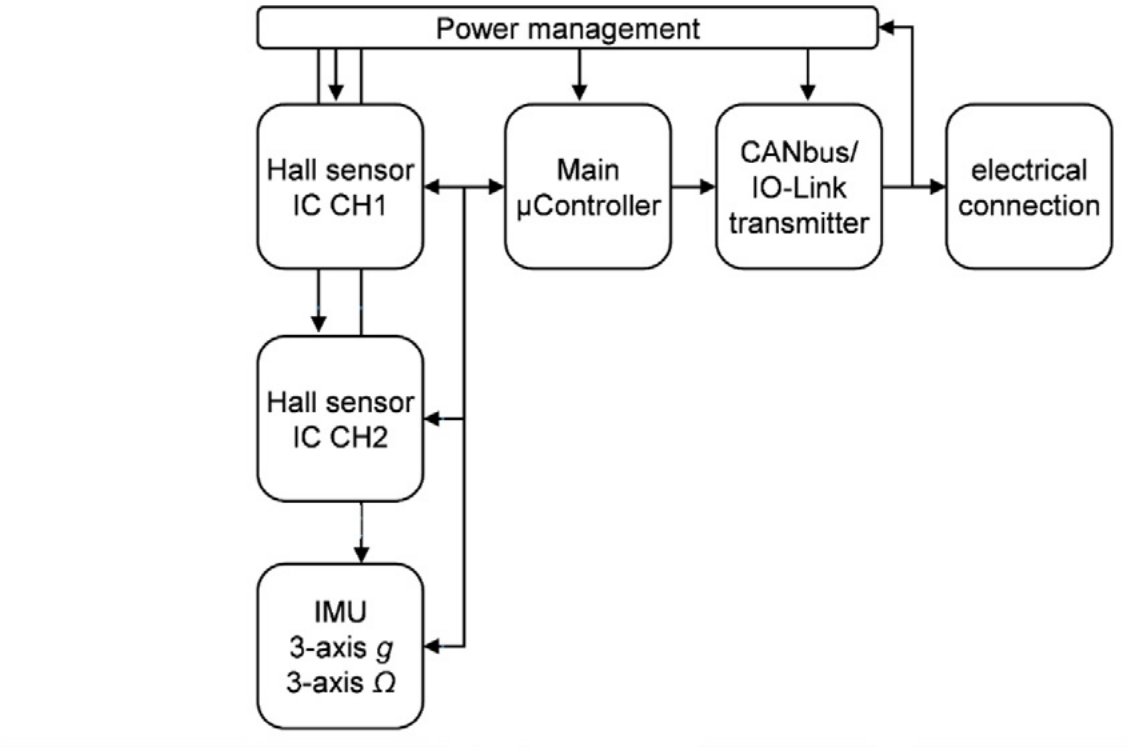


Figure 2. Architecture description: block diagram

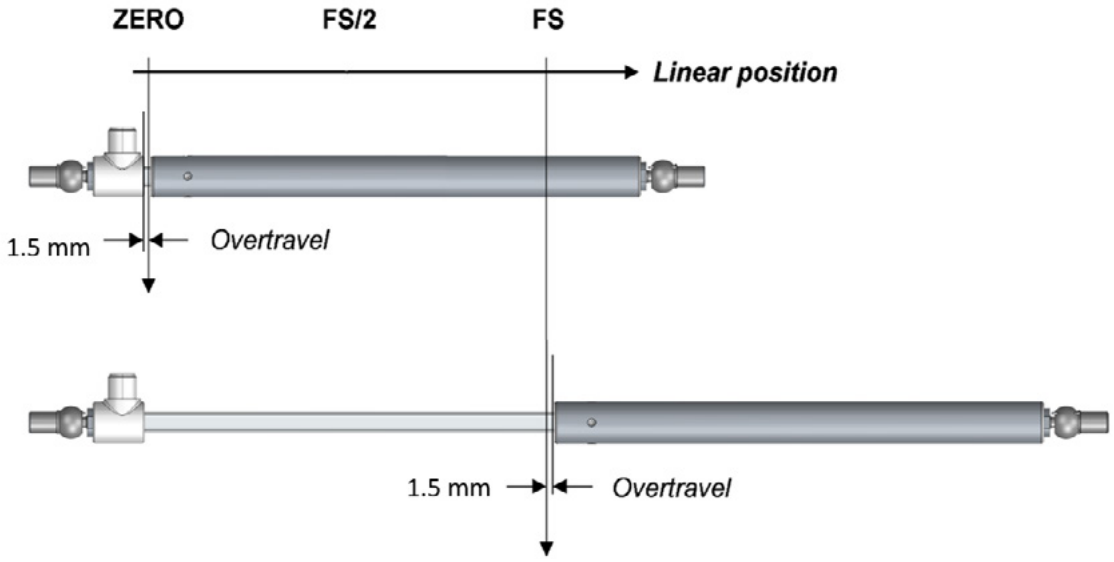


Figure 3. Examples of position measurement

1.1.2. Tilt sensing

The Gefran LM-L sensor in the “multivariable” version includes an inertial module composed of a triaxial accelerometer and a triaxial gyroscope. The sensing axes orientation is described in Figure 4: X, Y, and Z are related to the accelerometer, while Ωx, Ωy and Ωz are related to the gyroscope. These 6-D raw measurements are transmitted by the sensor to the user control unit to permit custom processing.

A sensor fusion algorithm based on the Kalman filter, suitable for the estimation of 3-D orientation in space, is also embedded in the sensor firmware. It acquires data from the accelerometer and gyroscope and provides information about the device position, i.e., quaternions and Euler angles (pitch, roll, yaw) as shown in Figure 5.

Pitch ranges from -180 deg to +180 deg, while roll ranges from -90 deg to +90 deg as describes in Figure 6 and Figure 8.

Pitch angle sweeps the entire measurement range only if roll is around the 0-deg position. The farther roll is from the 0-deg position, the greater the pitch angle measurement error will be. Furthermore, for roll angles close to the edges of the measurement range it is not possible to perform an accurate pitch measurement. For this reason, the user is advised to select the correct IMU orientation parameter according to the sensor mounting orientation shown in Figure 9.

Yaw calculation is provided by integration of gyroscope data, as a relative angle position measurement respect to the power-on sensor position that is considered as 0-deg yaw position.

Tilt angle measurements can be low pass filtered by using a moving average filter by selecting the filter tap.

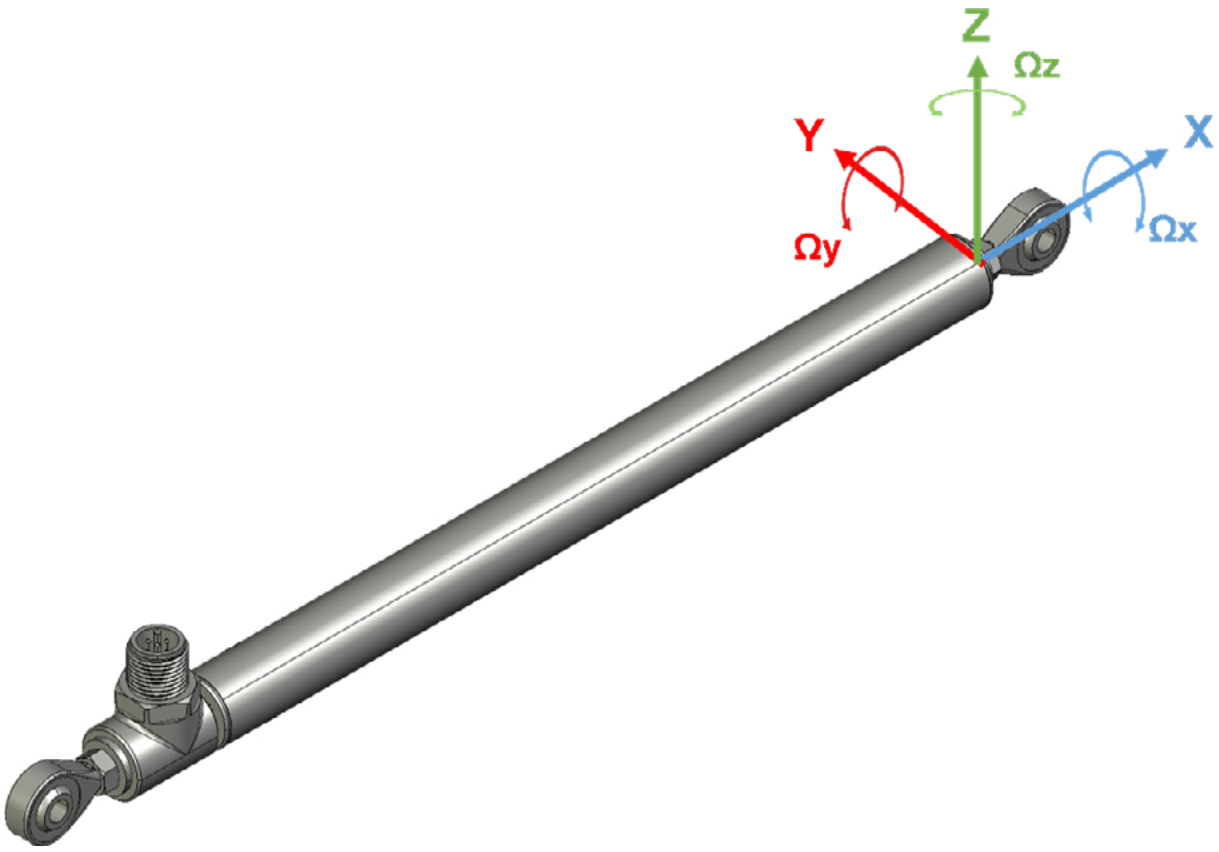


Figure 4. Inertial module sensing axes orientations

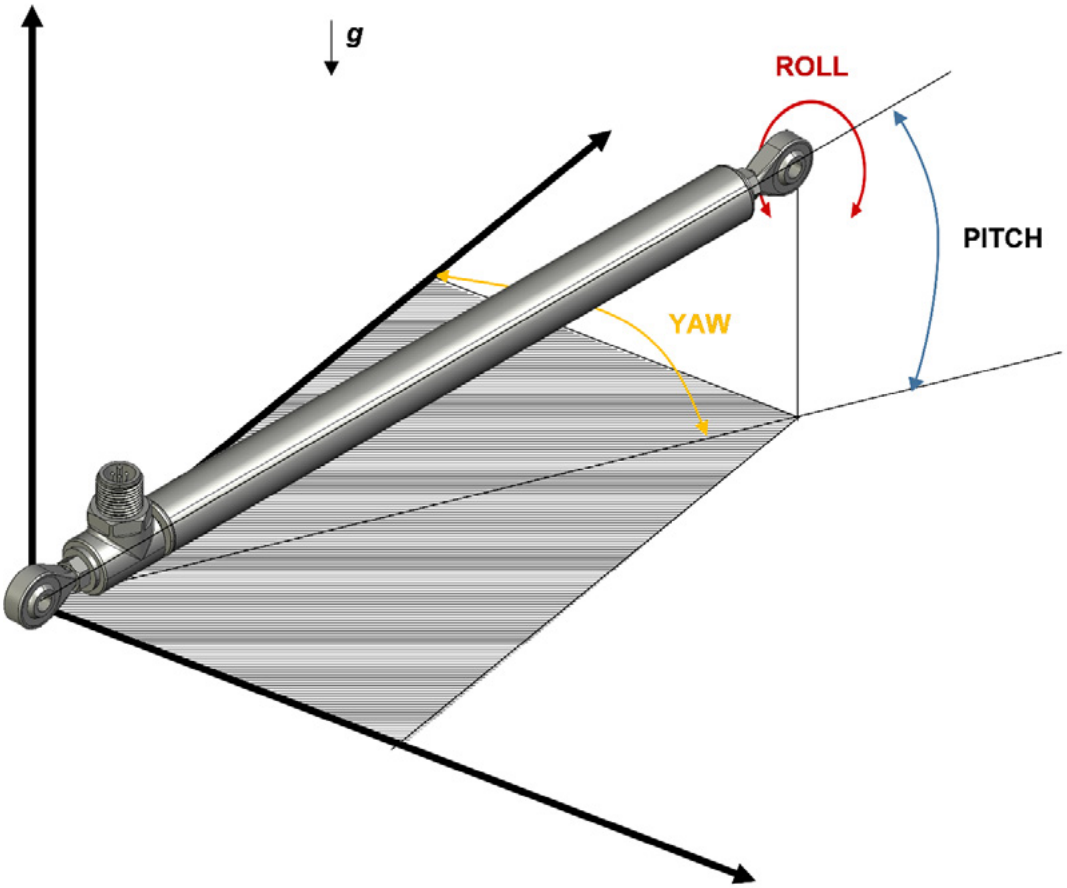


Figure 5. Tilt sensing axes orientations

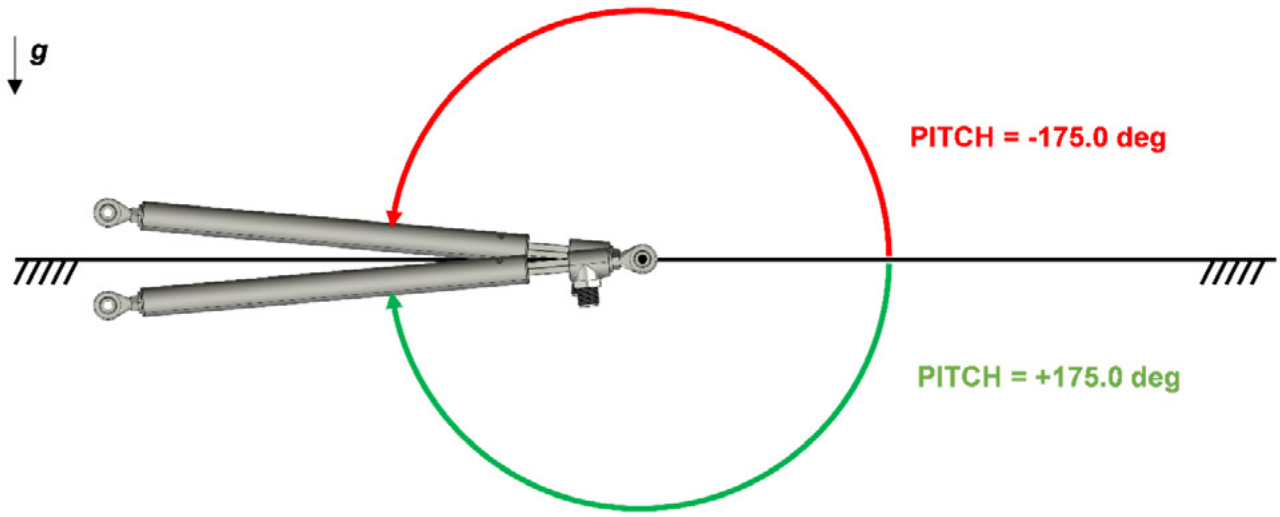


Figure 6. Example of position measurement: pitch = +/-175 deg

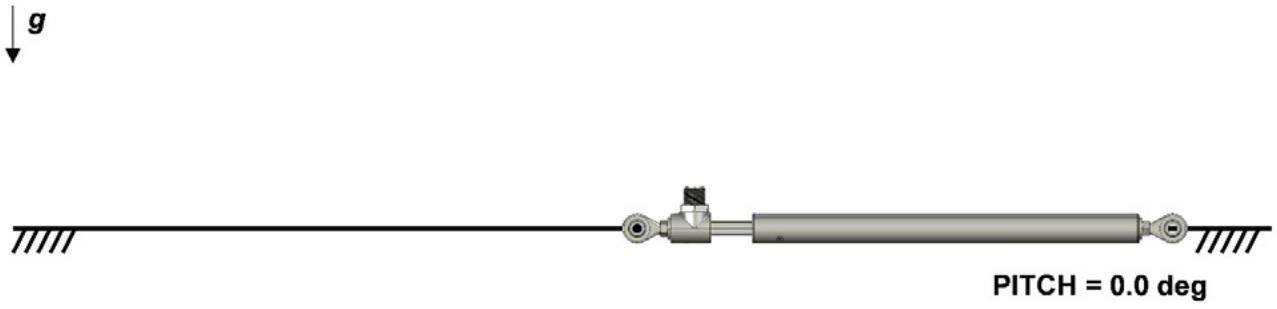


Figure 7. Example of position measurement: pitch = 0 deg

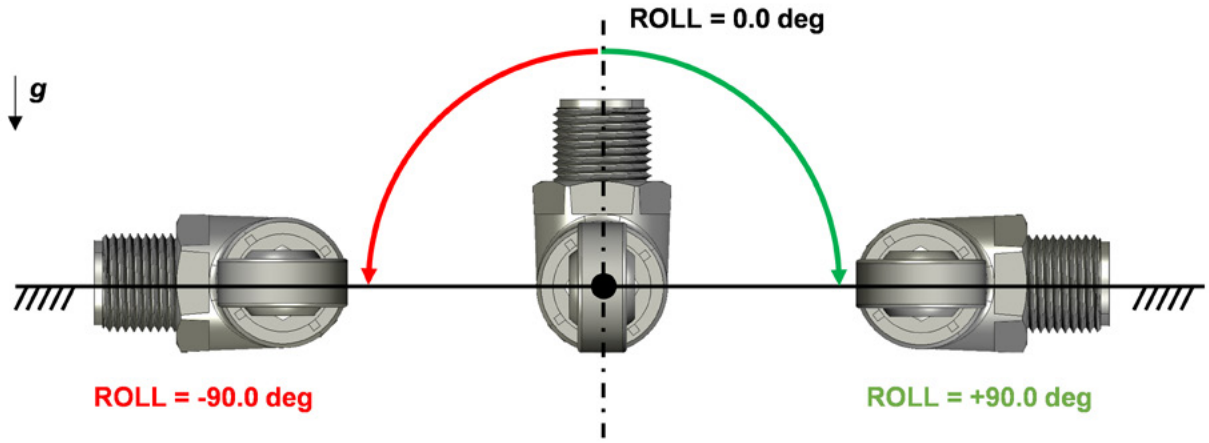


Figure 8. Example of position measurement: roll =-90…0…+90 deg

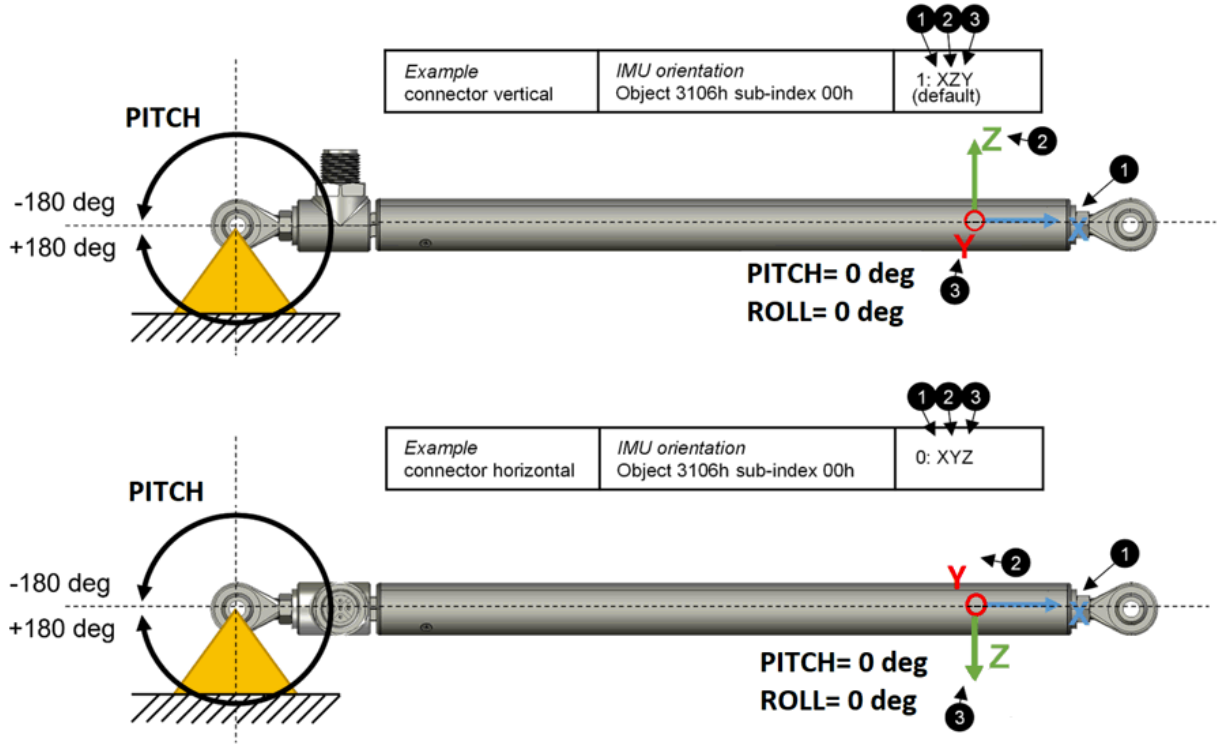


Figure 9. IMU orientation parameter according to the sensor mounting orientation

1.2. Process data mapping

In this section an example of Process Data Input (PDI) is presented.

Standard version supports the following PDI mapping containing position; the resolution of position measurement value is .

PDI Standard Mapping

Position (32 bit) + scale (8 bit) + filling (6 bit) + SSC1 (2 bit)

Table 1. Standard PDI Mapping (48 bit)

47…16	15…8	7…2	1	0
position	scale		SSC1_2	SSC1_1

In addition to standard PDI mapping, two special versions including tilt or acceleration measurements are available on request. For these or other custom specific PDI mapping, please contact Gefran.

- ***Special version 1 - TILT(192 bit):***

Position (32 bit) + scale (8 bit) + filling (6 bit) + SSC1 (2 bit) +

Tilt X (32 bit) + scale (8 bit) + filling (6 bit) + SSC2 (2 bit) +

Tilt Y (32 bit) + scale (8 bit) + filling (6 bit) + SSC3 (2 bit) +

Tilt Z (32 bit) + scale (8 bit) + filling (6 bit) + SSC4 (2 bit)

Table 2. Special version 1 PDI Mapping (192 bit)

191…160	159…152	151…146	145	144
Position	Position scale		SSC1_2	SSC1_1

143…112	111…104	103…98	97	96
tilt X	tilt X scale		SSC2_2	SSC2_1

95…64	63…56	55…50	49	48
tilt Y	tilt Y scale		SSC3_2	SSC3_1

47…16	15…8	7…2	1	0
tilt Z	tilt Z scale		SSC4_2	SSC4_1

- ***Special version 2 - ACCELERATION (192 bit):***

Position (32 bit) + scale (8 bit) + filling (6 bit) + SSC1 (2 bit) +

Acceleration X (32 bit) + scale (8 bit) + filling (6 bit) + SSC2 (2 bit) +

Acceleration Y (32 bit) + scale (8 bit) + filling (6 bit) + SSC3 (2 bit) +

Acceleration Z (32 bit) + scale (8 bit) + filling (6 bit) + SSC4 (2 bit)

Table 3. Special version 2 PDI Mapping (192 bit)

191…160	159…152	151…146	145	144
Position	Position scale		SSC1_2	SSC1_1

143…112	111…104	103…98	97	96
acceleration X	acceleration X scale		SSC2_2	SSC2_1

95…64	63…56	55…50	49	48
acceleration Y	acceleration Y scale		SSC3_2	SSC3_1

47…16	15…8	7…2	1	0
acceleration Z	acceleration Z scale		SSC4_2	SSC4_1

Note: Different mapping leads to different IODDs, please refer to Gefran for the proper IODD (i.e., tilt IODD, acceleration IODD).

2. ELECTRICAL CONNECTIONS

The LM-L has a M12 5 poles connector, pinout is described in Figure 10:

PIN	M12 5 pole connector
1	V+
2	N.C. (not internally connected)
3	V-
4	IO-Link
5	N.C. (not internally connected)

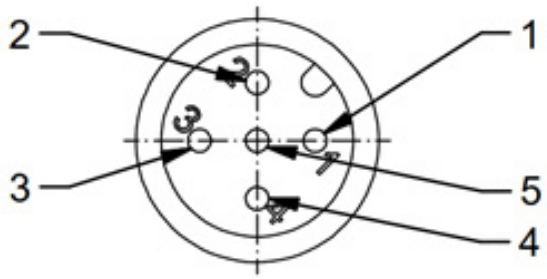


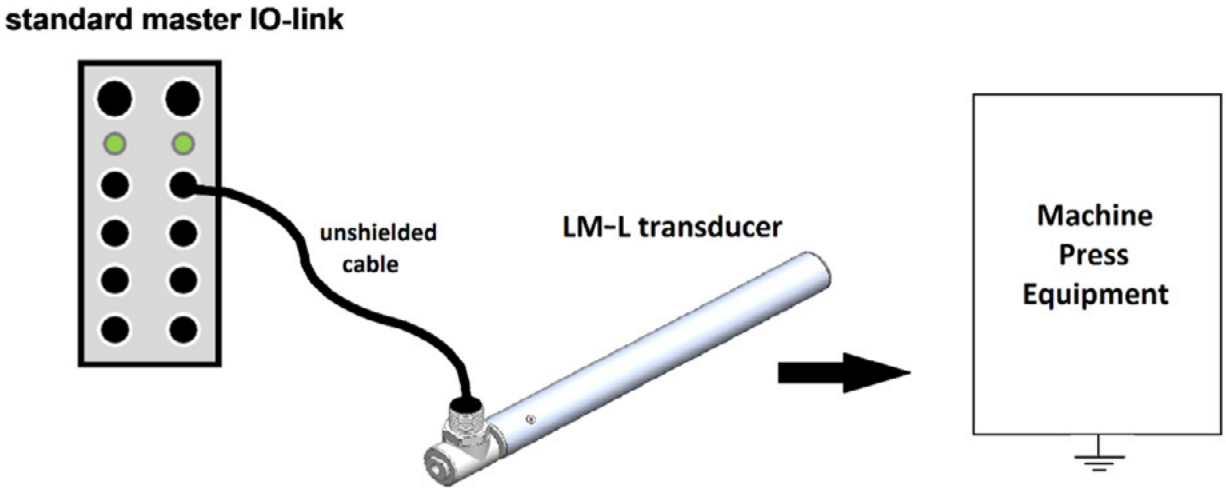
Figure 10. M12 5 poles connections

To prevent interference, separate the power cables from signal cables.

Please consider the following 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.

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



3. GET START PROCEDURE

3.1. Default parameters

In this section the principal parameters of Gefran LM-L sensor and the associated default values are presented:

Table 4. LM-L IO-Link parameters

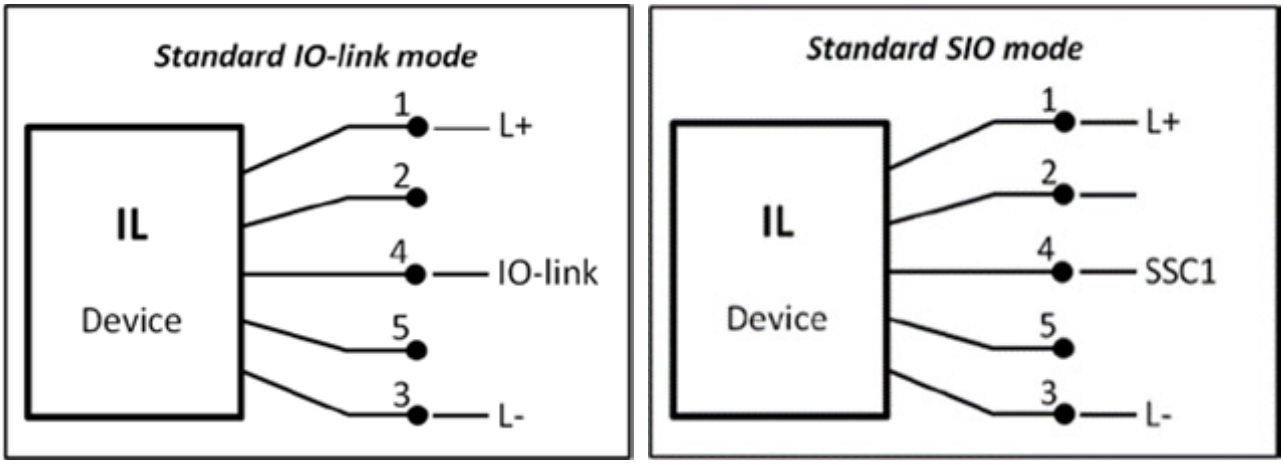
	Value
Port Class	A
Baud-rate	COM3 (230.4 kbit/s)
IO-Link version (1)	1.1
Profile	Generic Smart Sensor
Process data input type /length (2)	0
Process data output length	48 bit: Position (32 bit) + scale (8 bit) + filling (6 bit) + SSC1 (2 bit)
Min Cycle Time	1 ms
SIO mode	Supported
ISDU	Supported
Data 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. IO-Link mode and SIO mode

Gefran LM-L sensor supports both IO-Link mode and SIO mode.



In particular, when working in SIO mode the transducer behaves like a digital sensor: on pin 4 of M12 connector one digital thresholds is available and programmable (replicating the same behaviour configured for SSC1).

Note: IO-Link pin represents digital communication pin in Standard IO-link mode or switching signal channel 1 (SSC1) pin in Standard SIO mode.

4. PARAMETRIZATION DATA

The available parameters of the Gefran LM-L IO-Link device, specified in the following tables, are grouped in system, identification, diagnosis, profile specific and profile parameters; all available parameters are present in the IODD file.

Note: Tilt or acceleration version IODDs present additional parameters respecting to standard IODD.

4.1. Predefined parameters - System

Index	Subindex	Object name	Access			Data Type	Value (default)	Description
			U	M	S			
0x0002	0x00	System Command	W	W	W	Uint8	See table below	

Note: U = user; M = maintenance; S = specialist; - stays for command not available

System command values

Value	Access			Command	Data Type	Description
	U	M	S			
0x01	-	W	W	ParamUploadStart	Uint8	
0x02	-	W	W	ParamUploadEnd	Uint8	
0x03	-	W	W	ParamDownloadStart	Uint8	
0x04	-	W	W	ParamDownloadEnd	Uint8	
0x05	-	W	W	ParamDownloadStore	Uint8	
0x06	-	W	W	ParamBreak	Uint8	
0x41	-	W	W	TeachSP1	Uint8	It allows to teach “Setpoint 1” (SP1) for the selected Switching Signal Chan- nel(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 Chan- nel(s). SP2 is defined by one “TeachPoint” (“Single value teach-in” mode)
0x50	-	W	W	BM_UNLOCK_S	Uint8	Start unlocking sequence
0x51	-	W	W	BM_UNLOCK_F	Uint8	Unlocking command 1
0x52	-	W	W	BM_UNLOCK_T	Uint8	Unlocking command 2
0x53	-	W	W	BM_ACTIVATE	Uint8	Stop communication and activate new FW
0x81	-	W	W	ApplicationReset	Uint8	Reset Application
0x83	-	W	W	BackToBox		Back To Box
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	TeachStartPositionTiltX	Uint8	Sets the initial value of the monitoring range area for tilt X
0xA5	-	W	W	TeachEndPositionTiltX	Uint8	Sets the final value of the monitoring range area for tilt X
0xA6	-	W	W	TeachStartPositionTiltY	Uint8	Sets the initial value of the monitoring range area for tilt Y
0xA7	-	W	W	TeachEndPositionTiltY	Uint8	Sets the final value of the monitoring range area for tilt Y
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

Value	Access			Command	Data Type	Description
	U	M	S			
0xAA	-	W	W	ResetOutOfMeasurementRangeCounter	UInt8	Reset the value of the following parameter: • ResetOutOfMeasurementRangeCounter
0xAB	-	W	W	ResetOutOfMonitoringRangeCounterTiltX	UInt8	Reset the value of the following parameter: •OutOfMonitoringRangeCounterTiltX
OxAC	-	W	W	ResetOutOfMeasurementRangeCounterTiltX	UInt8	Reset the value of the following parameter: •ResetOutOfMeasurementRangeCounterTiltX
0xAD	-	W	W	ResetOutOfMonitoringRangeCounterTiltY	UInt8	Reset the value of the following parameter: •OutOfMonitoringRangeCounterTiltY
OxAE	-	W	W	ResetOutOfMeasurementRangeCounterTiltY	UInt8	Reset the value of the following parameter: •ResetOutOfMeasurementRangeCounterTiltY
0xAF	-	W	W	ResetOutOfMonitoringRangeCounterTiltZ	UInt8	Reset the value of the following parameter: •OutOfMonitoringRangeCounterTiltZ
OxB0	-	W	W	ResetOutOfMeasurementRangeCounterTiltZ	UInt8	Reset the value of the following parameter: •ResetOutOfMeasurementRangeCounterTiltZ
0xB1	-	W	W	ResetOutOfMonitoringRangeCounterAccX	UInt8	Reset the value of the following parameter: • OutOfMonitoringRangeCounterAccX
OxB2	-	W	W	ResetOutOfMeasurementRangeCounterAccX	UInt8	Reset the value of the following parameter: •ResetOutOfMeasurementRangeCounterAccX
0xB3	-	W	W	ResetOutOfMonitoringRangeCounterAccY	UInt8	Reset the value of the following parameter: • OutOfMonitoringRangeCounterAccY
OxB4	-	W	W	ResetOutOfMeasurementRangeCounterAccY	UInt8	Reset the value of the following parameter: •ResetOutOfMeasurementRangeCounterAccY
0xB5	-	W	W	ResetOutOfMonitoringRangeCounterAccZ	UInt8	Reset the value of the following parameter: • OutOfMonitoringRangeCounterAccZ
0xB6	-	W	W	ResetOutOfMeasurementRangeCounterAccZ	UInt8	Reset the value of the following parameter: •ResetOutOfMeasurementRangeCounterAccZ
0xB7	-	W	W	TeachStartPositionTiltZ	Uint8	Sets the initial value of the monitoring range area for tilt Z
0xB8	-	W	W	TeachEndPositionTiltZ	Uint8	Sets the final value of the monitoring range area for tilt Z
OxB9	-	W	W	TeachStartPositionAccX	Uint8	Sets the initial value of the monitoring range area for accelaration X
0xBA	-	W	W	TeachEndPositionAccX	Uint8	Sets the final value of the monitoring range area for accelaration X
0xBB	-	W	W	TeachStartPositionAccY	Uint8	Sets the initial value of the monitoring range area for accelaration Y
0xBC	-	W	W	TeachEndPositionAccY	Uint8	Sets the final value of the monitoring range area for accelaration Y
0xBD	-	W	W	TeachStartPositionAccZ	Uint8	Sets the initial value of the monitoring range area for accelaration Z
0xBE	-	W	W	TeachEndPositionAccZ	Uint8	Sets the final value of the monitoring range area for accelaration Z
0xBF	-	W	W	ResetTemperatureMax	UInt8	Reset the value of the following parameter: • TemperatureMax
0xC0	-	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)

Value	Access			Command	Data Type	Description
	U	M	S			
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)

4.2. Predefined parameters – Identification

Index	Subindex	Object name	Access			Data Type	Value	Description
			U	M	S			
0x0010	0x00	VendorName	RO	RO	RO	Uint8	GEFRAN spa	
0x0011	0x00	VendorText	RO	RO	RO	String	www.gefran.com	
0x0012	0x00	ProductName	RO	RO	RO	String	-	Full description of product
0x0013	0x00	ProductID	RO	RO	RO	String	LM-L-A-xxxx x000Xxx0X	Model type
0x0014	0x00	ProductText	RO	RO	RO	String	GEFRAN TWIIST Technology Transducer	User friendly description of the product
0x0015	0x00	SerialNumber	RO	RO	RO	String	-	Unique serial number printed on label
0x0016	0x00	HardwareRevision	RO	RO	RO	String	1	
0x0017	0x00	FirmwareRevision	RO	RO	RO	String	1	
0x0018	0x00	ApplicationSpecificTag	RO	RW	RW	String	*** (Default)	User specifies a tag which defines functionality, position of the transducer in the system
0x0019	0x00	FunctionTag	RO	RW	RW	String	Empty (Default)	User specifies a tag which defines functionality, position of the transducer in the system
0x001A	0x00	LocationTag	RO	RW	RW	String	Empty (Default)	User specifies a tag which defines functionality, position of the transducer in the system

4.3. Predefined parameters – Diagnosis

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

4.4. Device status possible values

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

4.5. Errors and warnings in Detailed Device Status

Event code	Event Description	Event type	Device Status	Possible Failure	Process Data Value	Reset Condition
0x8DFD	TestEventError	Error	Maintenance required	Event used by user for testing “Error” type events	not changed	By using the “TestEventError” command “error disappear”
0x8DFE	TestEventWarning	Warning	Maintenance required	Event used by user for testing “Warning” type events	not changed	By using the “TestEventWarning” command “warning disappear”
0x8DFF	TestEventNotification	Notification	Maintenance required	Event used by user for testing “Notification” type events	not changed	-
0x8CA0	PrimaryElementError	Error	Maintenance required	Hardware error on primary element	Fixed value: 2147483640	Error is reset when hardware error on primary element disappears
0x8CA1	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
0x8CA2	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 position below the higher threshold, or change threshold value
0x8CA3	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 position above the lower threshold, or change threshold value
0x8CA4	Tilt X above monitoring range	Warning	Maintenance required	Tilt X value is higher than the upper value of the monitoring range area defined by the user	not changed	Keep the sensor inclination below the higher threshold, or change threshold value

Event code	Event Description	Event type	Device Status	Possible Failure	Process Data Value	Reset Condition
0x8CA5	Tilt X below monitoring range	Warning	Maintenance required	Tilt X value is lower than the lower value of the monitoring range area defined by the user	not changed	Keep the cursor inclination above the lower threshold, or change threshold value
0x8CA6	Tilt Y above monitoring range	Warning	Maintenance required	Tilt Y value is higher than the upper value of the monitoring range area defined by the user	not changed	Keep the sensor inclination below the higher threshold, or change threshold value
0x8CA7	Tilt Y below monitoring range	Warning	Maintenance required	Tilt Y value is lower than the lower value of the monitoring range area defined by the user	not changed	Keep the sensor inclination above the lower threshold, or change threshold value
0x8CA8	Tilt Z above monitoring range	Warning	Maintenance required	Tilt Z value is higher than the upper value of the monitoring range area defined by the user	not changed	Keep the sensor inclination below the higher threshold, or change threshold value
0x8CA9	Tilt Z below monitoring range	Warning	Maintenance required	Tilt Z value is lower than the lower value of the monitoring range area defined by the user	not changed	Keep the sensor inclination above the lower threshold, or change threshold value
0x8CAA	Acceleration X above monitoring range	Warning	Maintenance required	Acceleration X value is higher than the upper value of the monitoring range area defined by the user	not changed	Keep the sensor acceleration below the higher threshold, or change threshold value
0x8CAB	Acceleration X below monitoring range	Warning	Maintenance required	Acceleration X value is lower than the lower value of the monitoring range area defined by the user	not changed	Keep the sensor acceleration above the lower threshold, or change threshold value
0x8CAC	Acceleration Y above monitoring range	Warning	Maintenance required	Acceleration Y value is higher than the upper value of the monitoring range area defined by the user	not changed	Keep the sensor acceleration below the higher threshold, or change threshold value
0x8CAD	Acceleration Y below monitoring range	Warning	Maintenance required	Acceleration Y value is lower than the lower value of the monitoring range area defined by the user	not changed	Keep the sensor acceleration above the lower threshold, or change threshold value
0x8CAE	Acceleration X above monitoring range	Warning	Maintenance required	Acceleration Z value is higher than the upper value of the monitoring range area defined by the user	not changed	Keep the sensor acceleration below the higher threshold, or change threshold value
0x8CAF	Acceleration X below monitoring range	Warning	Maintenance required	Acceleration Z value is lower than the lower value of the monitoring range area defined by the user	not changed	Keep the sensor acceleration above the lower threshold, or change threshold value
0x8C10	Process variable range overrun	Warning	Out of specification	Detected position of the sensor is above the calibration full-scale point	Fixed value: 2147483640	Keep the sensor position inside the working area defined by the manufacturer
0x8C20	Measurement range exceeded	Warning	Out of specification	No magnetic field detected by the sensor	Fixed value: 2147483640	Position the sensor, inside the working area defined by the manufacturer
0x8C30	Process variable range underrun	Warning	Out of specification	Detected position of the sensor is below the calibration zero point	Fixed value: -2147483640	Keep the sensor position inside the working area defined by the manufacturer

Event code	Event Description	Event type	Device Status	Possible Failure	Process Data Value	Reset Condition
0x4210	Device temperature overrun	Warning	Out of specification	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

4.6. 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).

4.7. Predefined parameters - Profile specific parameters

Index	Sub index	Object name	Access			Data Type	Value (default)	Value Range	Gradient	Offset	Unit	Description
			U	M	S							
0x003A	0x00	TeachInSelect	-	R/W	R/W	UInt8	0x00: SSC1.1 (default) 0x00: SSC1.1 (default) 0x01: SSC1.1 0x02: SSC1.2 0xFF: All Additional values available only for special version1 and 2: 0x0B: SSC2.1 0x0C: SSC2.2 0x15: SSC3.1 0x16: SSC3.2 0x1F: SSC4.1 0x20: SSC4.2	0…2,11, 12, 21, 22,31, 32, 255	-	-	-	Defines the channel to which address teach-in
0x003B	0x00	TeachIn Result	-	RO	RO	Record						Show the result of teach-in procedure
	0x01	State	-	RO	RO	UInt4	0 See Table 11	0…15	-	-	-	
	0x02	FlagSP1TP1	-	RO	RO	Boolean	0: SP1TP1 not taught 1...255: SP1TP1 taught	0...255	-	-	-	
	0x03	FlagSP1TP2	-	RO	RO	Boolean	0: SP1TP2 not taught 1...255: SP1TP2 taught	0...255	-	-	-	
	0x04	FlagSP2TP1	-	RO	RO	Boolean	0: SP2TP1 not taught 1...255: SP2TP1 taught	0...255	-	-	-	
	0x05	FlagSP2TP2	-	RO	RO	Boolean	0: SP2TP2 not taught 1...255: SP2TP2 taught	0...255	-	-	-	
0x003C	0x00	SSC1.1Param	RO	R/W	R/W	Record						Defines the switch-points of SSC1.1
	0x01	SP1	RO	R/W	R/W	Int32	FS (default)	-536870912 ..536870911	1	0	um	
	0x02	SP2	RO	R/W	R/W	Int32	0 (default)	-536870912 ..536870911	1	0	um	

Index	Sub index	Object name	Access			Data Type	Value (default)	Value Range	Gradient	Offset	Unit	Description
			U	M	S							
0x003D	0x00	SSC1.1Config	RO	R/W	R/W	Record						Defines the configuration of SSC1.1
	0x01	Logic	RO	R/W	R/W	UInt8	0x00: High active (default) 0x01: Low active	0…1	-	-	-	
	0x02	Mode	RO	R/W	R/W	UInt8	0x00: Deactivated (default) 0x01: Single point 0x02: Window 0x03: Two point	0…3	-	-	-	
	0x03	Hyst	RO	R/W	R/W	Int32	0x0000: no hysteresis Other values: hysteresis in um	0…10% FS	1	0	um	
0x003E	0x00	SSC1.2Param	RO	R/W	R/W	Record						Defines the switch-points of SSC1.2
	0x01	SP1	RO	R/W	R/W	Int32	FS (default)	-53687 0912.. 53687 0911	1	0	um	
	0x02	SP2	RO	R/W	R/W	Int32	0 (default)	-53687 0912.. 53687 0911	1	0	um	
0x003F	0x00	SSC1.2Config	RO	R/W	R/W	Record						Defines the configuration of SSC1.2
	0x01	Logic	RO	R/W	R/W	UInt8	0x00: High active (default) 0x01: Low active	0…1	-	-	-	
	0x02	Mode	RO	R/W	R/W	UInt8	0x00: Deactivated (default) 0x01: Single point 0x02: Window 0x03: Two point	0…3	-	-	-	
	0x03	Hyst	RO	R/W	R/W	Int32	0x0000: no hysteresis Other values: hysteresis in um	0…10%FS	1	0	um	
0x400C	0x00	SSC2.1Param	RO	R/W	R/W	Record						Defines the switch-points of SSC2.1
	0x01	SP1	RO	R/W	R/W	Int32						
	0x02	SP2	RO	R/W	R/W	Int32						
0x400D	0x00	SSC2.1Config	RO	R/W	R/W	Record						Defines the configuration of SSC2.1
	0x01	Logic	RO	R/W	R/W	UInt8	0x00: High active (default) 0x01: Low active	0…1	-	-	-	
	0x02	Mode	RO	R/W	R/W	UInt8	0x00: Deactivated (default) 0x01: Single point 0x02: Window 0x03: Two point	0…3	-	-	-	
	0x03	Hyst	RO	R/W	R/W	Int32	0x0000: no hysteresis		-	-	-	

Index	Sub index	Object name	Access			Data Type	Value (default)	Value Range	Gradient	Offset	Unit	Description
			U	M	S							
0x400E	0x00	SSC2.2Param	RO	R/W	R/W	Record						Defines the switch-points of SSC2.2
	0x01	SP1	RO	R/W	R/W	Int32						
	0x02	SP2	RO	R/W	R/W	Int32						
0x400F	0x00	SSC2.2Config	RO	R/W	R/W	Record						Defines the configuration of SSC2.2
	0x01	Logic	RO	R/W	R/W	UInt8	0x00: High active (default) 0x01: Low active	0…1	-	-	-	
	0x02	Mode	RO	R/W	R/W	UInt8	0x00: Deactivated (default) 0x01: Single point 0x02: Window 0x03: Two point	0…3	-	-	-	
	0x03	Hyst	RO	R/W	R/W	Int32	0x0000: no hysteresis		-	-	-	
0x401C	0x00	SSC3.1Param	RO	R/W	R/W	Record						Defines the switch-points of SSC3.1
	0x01	SP1	RO	R/W	R/W	Int32						
	0x02	SP2	RO	R/W	R/W	Int32						
0x401D	0x00	SSC3.1Config	RO	R/W	R/W	Record						Defines the configuration of SSC3.1
	0x01	Logic	RO	R/W	R/W	UInt8	0x00: High active (default) 0x01: Low active	0…1	-	-	-	
	0x02	Mode	RO	R/W	R/W	UInt8	0x00: Deactivated (default) 0x01: Single point 0x02: Window 0x03: Two point	0…3	-	-	-	
	0x03	Hyst	RO	R/W	R/W	Int32	0x0000: no hysteresis		-	-	-	
0x401E	0x00	SSC3.2Param	RO	R/W	R/W	Record						Defines the switch-points of SSC3.2
	0x01	SP1	RO	R/W	R/W	Int32						
	0x02	SP2	RO	R/W	R/W	Int32						
0x401F	0x00	SSC3.2Config	RO	R/W	R/W	Record						Defines the configuration of SSC3.2
	0x01	Logic	RO	R/W	R/W	UInt8	0x00: High active (default) 0x01: Low active	0…1	-	-	-	
	0x02	Mode	RO	R/W	R/W	UInt8	0x00: Deactivated (default) 0x01: Single point 0x02: Window 0x03: Two point	0…3	-	-	-	
	0x03	Hyst	RO	R/W	R/W	Int32	0x0000: no hysteresis		-	-	-	
0x402C	0x00	SSC4.1Param	RO	R/W	R/W	Record						Defines the switch-points of SSC4.1
	0x01	SP1	RO	R/W	R/W	Int32						
	0x02	SP2	RO	R/W	R/W	Int32						

Index	Sub index	Object name	Access			Data Type	Value (default)	Value Range	Gradient	Offset	Unit	Description
			U	M	S							
0x402D	0x00	SSC4.1Config	RO	R/W	R/W	Record						Defines the configuration of SSC4.1
	0x01	Logic	RO	R/W	R/W	UInt8	0x00: High active (default) 0x01: Low active	0…1	-	-	-	
	0x02	Mode	RO	R/W	R/W	UInt8	0x00: Deactivated (default) 0x01: Single point 0x02: Window 0x03: Two point	0…3	-	-	-	
	0x03	Hyst	RO	R/W	R/W	Int32	0x0000: no hysteresis		-	-	-	
0x402E	0x00	SSC4.2Param	RO	R/W	R/W	Record						Defines the switchpoints of SSC4.2
	0x01	SP1	RO	R/W	R/W	Int32						
	0x02	SP2	RO	R/W	R/W	Int32						
0x402F	0x00	SSC4.2Config	RO	R/W	R/W	Record						Defines the configuration of SSC4.2
	0x01	Logic	RO	R/W	R/W	UInt8	0x00: High active (default) 0x01: Low active	0…1	-	-	-	
	0x02	Mode	RO	R/W	R/W	UInt8	0x00: Deactivated (default) 0x01: Single point 0x02: Window 0x03: Two point	0…3	-	-	-	
	0x03	Hyst	RO	R/W	R/W	Int32	0x0000: no hysteresis		-	-	-	

4.8. Tech-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

4.9. Device Parameters – Preferred indices

Index	Sub index	Object name	Access			Data Type	Value (default)	Value Range	Gradient	Offset	Unit	Description
			U	M	S							
0x0040	0x00	MonitoringRang-eStartPositionAccX	RO	R/W	R/W	Int32	-2147482880	-2147482880… 2147482880	0.001	0	m/s²	Start position X-axis acceleration
0x0041	0x00	MonitoringRangeEnd-PositionAccX	RO	R/W	R/W	Int32	2147482880	-2147482880… 2147482880	0.001	0	m/s²	End position X-axis acceleration
0x0042	0x00	MonitoringRang-eStartPositionAccY	RO	R/W	R/W	Int32	-2147482880	-2147482880… 2147482880	0.001	0	m/s²	Start position Y-axis acceleration
0x0043	0x00	MonitoringRangeEnd-PositionAccY	RO	R/W	R/W	Int32	2147482880	-2147482880… 2147482880	0.001	0	m/s²	End position Y-axis acceleration
0x0044	0x00	MonitoringRang-eStartPositionAccZ	RO	R/W	R/W	Int32	-2147482880	-2147482880… 2147482880	0.001	0	m/s²	Start position Z-axis acceleration
0x0045	0x00	MonitoringRangeEnd-PositionAccZ	RO	R/W	R/W	Int32	2147482880	-2147482880… 2147482880	0.001	0	m/s²	End position Z-axis acceleration
0x0070	0x00	ZeroOffset	RO	R/W	R/W	Int32	0 (default)	-2147482880…0	1	0	um	Actual zero offset value
0x0072	0x00	FilterConstant	RO	R/W	R/W	UInt8	0: no filter (default)	0, 2, 4, 8, 16	-	-	-	Filter Constant for position filtering
0x0073	0x00	MeasurementDirection	RO	R/W	R/W	Boolean	0: forward (default) 1..255: backward	0...255	-	-	-	Direction for increas- ing measure. Forward: from the electronics housing to profile/ rod end. Backward: from profile/rod end to electronics housing
0x0074	0x00	MonitoringRang-eStartPosition	RO	R/W	R/W	Int32	0 (default)	-2147482880… 2147482880	1	0	um	Start point of position monitoring range
0x0075	0x00	MonitoringRangeEnd-Position	RO	R/W	R/W	Int32	FS (default)	-2147482880… 2147482880	1	0	um	End point of position monitoring range
0x0076	0x00	MonitoringRang-eStartPositionTiltX	RO	R/W	R/W	Int32	-180	-180…180	0.01	0	deg	Start position of tilt X monitoring range
0x0077	0x00	MonitoringRangeEnd-PositionTiltX	RO	R/W	R/W	Int32	180	-180…180	0.01	0	deg	End position tilt X monitoring range
0x0078	0x00	MonitoringRang-eStartPositionTiltY	RO	R/W	R/W	Int32	-90	-90…90	0.01	0	deg	Start position of tilt Y monitoring range
0x0079	0x00	MonitoringRangeEnd-PositionTiltY	RO	R/W	R/W	Int32	90	-90…90	0.01	0	deg	End position tilt Y monitoring range
0x007A	0x00	MonitoringRang-eStartPositionTiltZ	RO	R/W	R/W	Int32	-180	-180…180	0.01	0	deg	Start position of tilt Z monitoring range
0x007B	0x00	MonitoringRangeEnd-PositionTiltZ	RO	R/W	R/W	Int32	180	-180…180	0.01	0	deg	End position tilt Z monitoring range
0x007C	0x00	FilterConstantTilt	RO	R/W	R/W	UInt8	0: no filter (default)	0, 2, 4, 8, 16	-	-	-	Filter Constant for tilt filtering

Index	Sub index	Object name	Access			Data Type	Value (default)	Value Range	Gradient	Offset	Unit	Description
			U	M	S							
0x0082	0x00	SSC1.1SetDelay	RO	R/W	R/W	UInt16	0 (default)	0..500	0.1	0	s	SSC1.1 Delay time set
0x0083	0x00	SSC1.1ResetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	SSC1.1 Delay time reset
0x0084	0x00	SSC1.2SetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	SSC1.2 Delay time set
0x0085	0x00	SSC1.2ResetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	SSC1.2 Delay time reset
0x0086	0x00	SSC2.1SetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x0087	0x00	SSC2.1ResetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x0088	0x00	SSC2.2SetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x0089	0x00	SSC2.2ResetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x008A	0x00	SSC3.1SetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x008B	0x00	SSC3.1ResetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x008C	0x00	SSC3.2SetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x008D	0x00	SSC3.2ResetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x008E	0x00	SSC4.1SetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x008F	0x00	SSC4.1ResetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x0090	0x00	SSC4.2SetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x0091	0x00	SSC4.2ResetDelay	RO	R/W	R/W	Uint16	0 (default)	0..500	0.1	0	s	
0x0096	0x00	NominalSpan	RO	RO	RO	Uint32	FS	0..4000000	1	0	um	Nominal span of the device
0x097	0x00	SpecialExecutionTag	RO	RO	RO	String	XL123	-	-	-	-	String for special execution versions
0x0098	0x00	CalibrationDate	RO	RO	RO	String	20200608	-	-	-	-	Calibration date (yyyymmdd)
0x0099	0x00	LinearityError	RO	RO	RO	Uint32	2	0..4294967295	0.01	0	%	Linearity error at factory in %FS
0x00A0	0x00	OperatingTime Counter	RO	RO	RO	Uint32	0	0..4294967295	0.1	0	h	Operating hours from first power on
0x00A1	0x00	OperatingTimeIn-MovementCounter	RO	RO	RO	Uint32	0	0..4294967295	0.1	0	h	
0xB0	0x00	CursorDistance	RO	RO	RO	Uint32	0	0..4294967295	1	0	km	Distance covered by magnet
0xB1	0x00	OutOfMonitoring RangeCounter	RO	RO	RO	Uint32	0	0..4294967295	-	-	-	
0xB2	0x00	OutOfMeasurement RangeCounter	RO	RO	RO	Uint32	0	0..4294967295	-	-	-	
0xB4	0x00	Temperature	RO	RO	RO	Int32	0	- 32768..32767	1	0	°C	Measured temperature of electronics
0xB5	0x00	TemperatureMax	RO	RO	RO	Int32	0	- 32768..32767	1	0	°C	Maximum temperature of electronics registered
0xB6	0x00	TemperatureMax-PeaksCounter	RO	RO	RO	UInt32	0	0..4294967295	-	-	-	Counter of temperature over threshold
0xB7	0x00	V_TemperatureMax-PeaksCounterThreshold	RO	R/W	R/W	Int32	0	-300…850	1	0	°C	
0xCE	0x00	V_Position2	RO	RO	RO	Int32	-	-536870912.. 536870911	1	0	um	Linear position of channel 2 output
0xCF	0x00	V_Speed2	RO	RO	RO	Int32	-	-536870912.. 536870911	0.1	0	mm/s	Linear speed of channel 2 output

Index	Sub index	Object name	Access			Data Type	Value (default)	Value Range	Gradient	Offset	Unit	Description
			U	M	S							
0xD0	0x00	V_Position	RO	RO	RO	Int32	-	-536870912.. 536870911	1	0	um	Linear position of channel 1 output
0xD1	0x00	V_Speed	RO	RO	RO	Int32	-	-536870912.. 536870911	0.1	0	mm/s	Linear speed of channel 1 output
0xD2	0x00	Pitch	RO	RO	RO	Int32	-	-536870912.. 536870911	0.01	0	deg	Pitch output
0xD3	0x00	Roll	RO	RO	RO	Int32	-	-536870912.. 536870911	0.01	0	deg	Roll output
0xD4	0x00	Yaw	RO	RO	RO	Int32	-	-536870912.. 536870911	0.01	0	deg	Yaw output
0xD5	0x00	Quaternion_W	RO	RO	RO	Int32	-	-536870912.. 536870911	0.01	0	-	Quaternion scalar part W
0xD6	0x00	Quaternion_X	RO	RO	RO	Int32	-	-536870912.. 536870911	0.01	0	-	Quaternion scalar part X
0xD7	0x00	Quaternion_Y	RO	RO	RO	Int32	-	-536870912.. 536870911	0.01	0	-	Quaternion scalar part Y
0xD8	0x00	Quaternion_Z	RO	RO	RO	Int32	-	-536870912.. 536870911	0.01	0	-	Quaternion scalar part Z
0xD9	0x00	Gravity_X	RO	RO	RO	Int32	-	-536870912.. 536870911	0.01	0	g	Raw data output angular rate sensor X axis
0xDA	0x00	Gravity_Y	RO	RO	RO	Int32	-	-536870912.. 536870911	0.01	0	g	Raw data output angular rate sensor Y axis
0xDB	0x00	Gravity_Z	RO	RO	RO	Int32	-	-536870912.. 536870911	0.01	0	g	Raw data output angular rate sensor Z axis
0xDC	0x00	LinearAcceleration_X	RO	RO	RO	Int32	-	-536870912.. 536870911	0.001	0	m/s²	Raw data output accelerometer sensor X axis
0xDD	0x00	LinearAcceleration_Y	RO	RO	RO	Int32	-	-536870912.. 536870911	0.001	0	m/s²	Raw data output accelerometer sensor Y axis
0xDE	0x00	LinearAcceleration_Z	RO	RO	RO	Int32	-	-536870912.. 536870911	0.001	0	m/s²	Raw data output accelerometer sensor Z axis
0xDF	0x00	OutOfMonitoringRangeCounterTiltX	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of Tilt X out of MonitoringRange
0xE0	0x00	OutOfMeasurementRangeCounterTiltX	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of Tilt X out not valid
0xE1	0x00	OutOfMonitoringRangeCounterTiltY	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of Tilt Y out of MonitoringRange
0xE2	0x00	OutOfMeasurementRangeCounterTiltY	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of Tilt Y out not valid
0xE3	0x00	V_OutOfMonitoringRangeCounterTiltZ	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of Tilt Z out of MonitoringRange
0xE4	0x00	V_OutOfMeasurementRangeCounterTiltZ	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of Tilt Z out not valid
0xE5	0x00	V_OutOfMonitoringRangeCounterAccX	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of LinearAcceleration X out of MonitoringRange
0xE6	0x00	V_OutOfMeasurementRangeCounterAccX	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of LinearAcceleration X out not valid

Index	Sub index	Object name	Access			Data Type	Value (default)	Value Range	Gradient	Offset	Unit	Description
			U	M	S							
0xE7	0x00	V_OutOfMonitoringRangeCounterAccY	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of LinearAcceleration Y out of MonitoringRange
0xE8	0x00	V_OutOfMeasurementRangeCounterAccY	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of LinearAcceleration Y out not valid
0xE9	0x00	V_OutOfMonitoringRangeCounterAccZ	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of LinearAcceleration Z out of MonitoringRange
0xE10	0x00	V_OutOfMeasurementRangeCounterAccZ	RO	R/W	R/W	UInt32	-	0..4294967295	-	-	-	counter of LinearAcceleration Z out not valid
0x4080	0x00	V_MDC1Descr	RO	RO	RO	Record						
	0x01	lower value	RO	RO	RO	Int32	-2147482880	-2147482880	-	-	-	Lower value of MDC1
	0x02	upper value	RO	RO	RO	Int32	2147482880	2147482880	-	-	-	Upper value of MDC1
	0x03	unit code	RO	RO	RO	UInt16	1014	1014	-	-	-	Code of MDC1
	0x04	Scale	RO	RO	RO	UInt8	0		-	-	-	Scale of MDC1
0x4081	0x00	V_MDC2Descr	RO	RO	RO	Record			-	-	-	
	0x01	lower value	RO	RO	RO	Int32	‘-180 per tilt X e Z; -90 per tilt Y; -2147482880 per acc	-180, -90, -2147482880	-	-	-	Lower value of MDC2
	0x02	upper value	RO	RO	RO	Int32	180 per tilt X e Z; 90 per tilt Y; 2147482880 per acc	180, 90, 2147482880	-	-	-	Upper value of MDC2
	0x03	unit code	RO	RO	RO	UInt16	1005 per tilt; 1076 per acceleration	1005, 1076	-	-	-	Code of MDC2
	0x04	Scale	RO	RO	RO	UInt8	-2 per tilt; -3 per acceleration	-2, -3	-	-	-	Scale of MDC2
0x4082	0x00	V_MDC3Descr	RO	RO	RO	Record			-	-	-	
	0x01	lower value	RO	RO	RO	Int32	‘-180 per tilt X e Z; -90 per tilt Y; -2147482880 per acc	-180, -90, -2147482880	-	-	-	Lower value of MDC3
	0x02	upper value	RO	RO	RO	Int32	180 per tilt X e Z; 90 per tilt Y; 2147482880 per acc	180, 90, 2147482880	-	-	-	Upper value of MDC3
	0x03	unit code	RO	RO	RO	UInt16	1005 per tilt; 1076 per acceleration	1005, 1076	-	-	-	Code of MDC3
	0x04	Scale	RO	RO	RO	UInt8	-2 per tilt; -3 per acceleration	-2, -3	-	-	-	Scale of MDC3

Index	Sub index	Object name	Access			Data Type	Value (default)	Value Range	Gradient	Offset	Unit	Description
			U	M	S							
0x4083	0x00	V_MDC4Descr	RO	RO	RO	Re-cord			-	-	-	
	0x01	lower value	RO	RO	RO	Int32	‘-180 per tilt X e Z; -90 per tilt Y; -2147482880 per acc	-180, -90, -2147482880	-	-	-	Lower value of MDC4
	0x02	upper value	RO	RO	RO	Int32	180 per tilt X e Z; 90 per tilt Y; 2147482880 per acc	180, 90, 2147482880	-	-	-	Upper value of MDC4
	0x03	unit code	RO	RO	RO	UInt16	1005 per tilt; 1076 per ac-celeration	1005, 1076	-	-	-	Code of MDC4
	0x04	Scale	RO	RO	RO	UInt8	-2 per tilt; -3 per accel-eration	-2, -3	-	-	-	Scale of MDC4

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	Subindex	Object name
0x0018	0x00	ApplicationSpecificTag
0x0019	0x00	FunctionTag
0x001A	0x00	LocationTag
0x003C	0x00	SSC1.1Param
0x003D	0x00	SSC1.1Config
0x003E	0x00	SSC1.2Param
0x003F	0x00	SSC1.2Config
0x0071	0x00	Resolution
0x0072	0x00	FilterConstant
0x0073	0x00	MeasurementDirection
0x0074	0x00	MonitoringRangeStartPosition
0x0075	0x00	MonitoringRangeEndPosition
0x0076	0x00	MonitoringRangeStartPositionTiltX
0x0077	0x00	MonitoringRangeEndPositionTiltX
0x0078	0x00	MonitoringRangeStartPositionTiltY
0x0079	0x00	MonitoringRangeEndPositionTiltY
0x007A	0x00	MonitoringRangeStartPositionTiltZ
0x007B	0x00	MonitoringRangeEndPositionTiltZ
0x0040	0x00	MonitoringRangeStartPositionAccX
0x0041	0x00	MonitoringRangeEndPositionAccX
0x0042	0x00	MonitoringRangeStartPositionAccY
0x0043	0x00	MonitoringRangeEndPositionAccY
0x0044	0x00	MonitoringRangeStartPositionAccZ
0x0045	0x00	MonitoringRangeEndPositionAccZ
0x007C	0x00	FilterConstantTilt
0x0082	0x00	SSC1.1SetDelay
0x0083	0x00	SSC1.1ResetDelay
0x0084	0x00	SSC1.2SetDelay
0x0085	0x00	SSC1.2ResetDelay
0x0086	0x00	SSC2.1SetDelay
0x0087	0x00	SSC2.1ResetDelay
0x0088	0x00	SSC2.2SetDelay
0x0089	0x00	SSC2.2ResetDelay
0x008A	0x00	SSC3.1SetDelay
0x008B	0x00	SSC3.1ResetDelay
0x008C	0x00	SSC3.2SetDelay
0x008D	0x00	SSC3.2ResetDelay
0x008E	0x00	SSC4.1SetDelay
0x008F	0x00	SSC4.1ResetDelay
0x0090	0x00	SSC4.2SetDelay
0x0091	0x00	SSC4.2ResetDelay
0x00B7	0x00	TemperatureMaxPeaksCounterThreshold
0x400C	0x00	SSC2.1Param
0x400D	0x00	SSC2.1Config

Index	Subindex	Object name
0x400E	0x00	SSC2.2Param
0x400EF	0x00	SSC2.2Config
0x401C	0x00	SSC3.1Param
0x401D	0x00	SSC3.1Config
0x401E	0x00	SSC3.2Param
0x4001F	0x00	SSC3.2Config
0x402C	0x00	SSC4.1Param
0x402D	0x00	SSC4.1Config
0x402E	0x00	SSC4.2Param
0x4002F	0x00	SSC4.2Config

6. SWITCHING SIGNAL CHANNELS (SSCS)

With standard PDI mapping (Position + SSC1) the device offers a digital output:

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

Ordering special version 1 (including tilt measurements) and version 2 (including acceleration measurements) PDI mapping, the device offers also other digital outputs (SSC2, SSC3 and SSC4):

- Logical, inside process data (bit 0 and bit 1), during IO-Link mode communication

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 Hysteresis parameter)
  - 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:

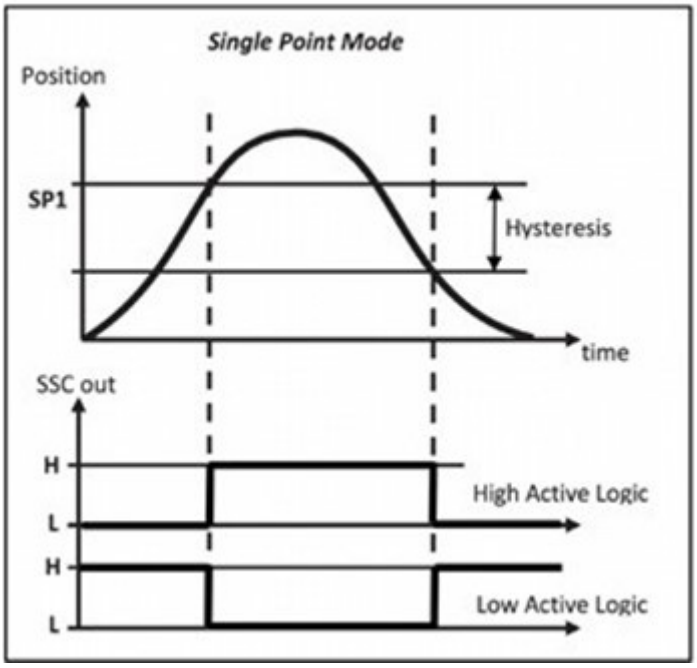


Figure 11. Single point mode

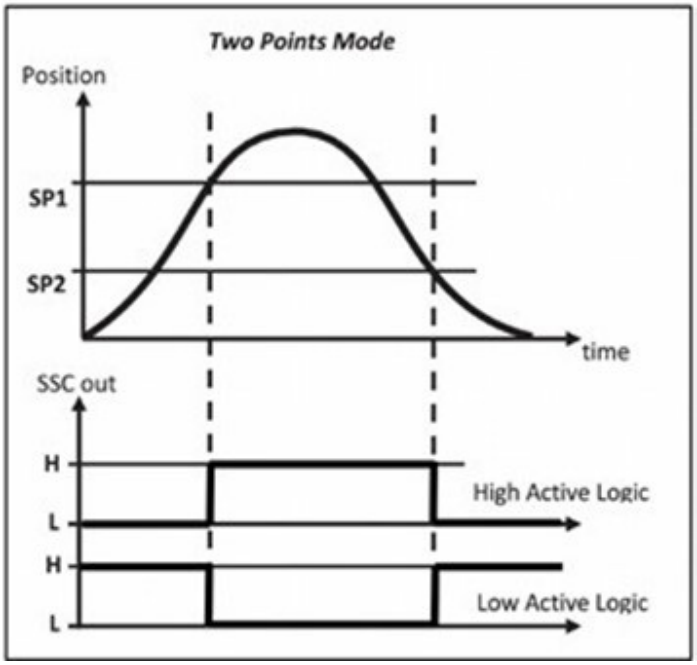


Figure 12. Two points mode

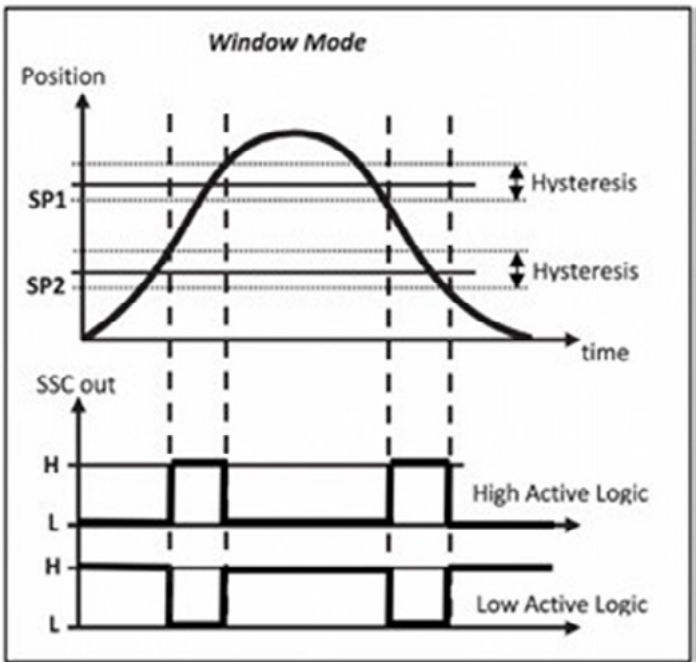


Figure 13. Window mode

SP1 and SPI2 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)

2) Through Teach-in procedure applied to SSC1, 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.

7. BOOTLOADER

Bootloader functionality allows to upgrade firmware of the Gefran LM-L sensor.

To download a new firmware version, through bootloader functionality, perform the following instructions:

1) Press “Import IOLFW (IO-Link Device Firmware Package)”

2) Press “Import Firmware package”

3) Select IOLFW file

4) Press “Import”

5) Insert password “GEFRAN-FW-UPDATE”

6) Press “Update Firmware”

Figure 14, Figure 15 and Figure 16 show an example of firmware update instructions:

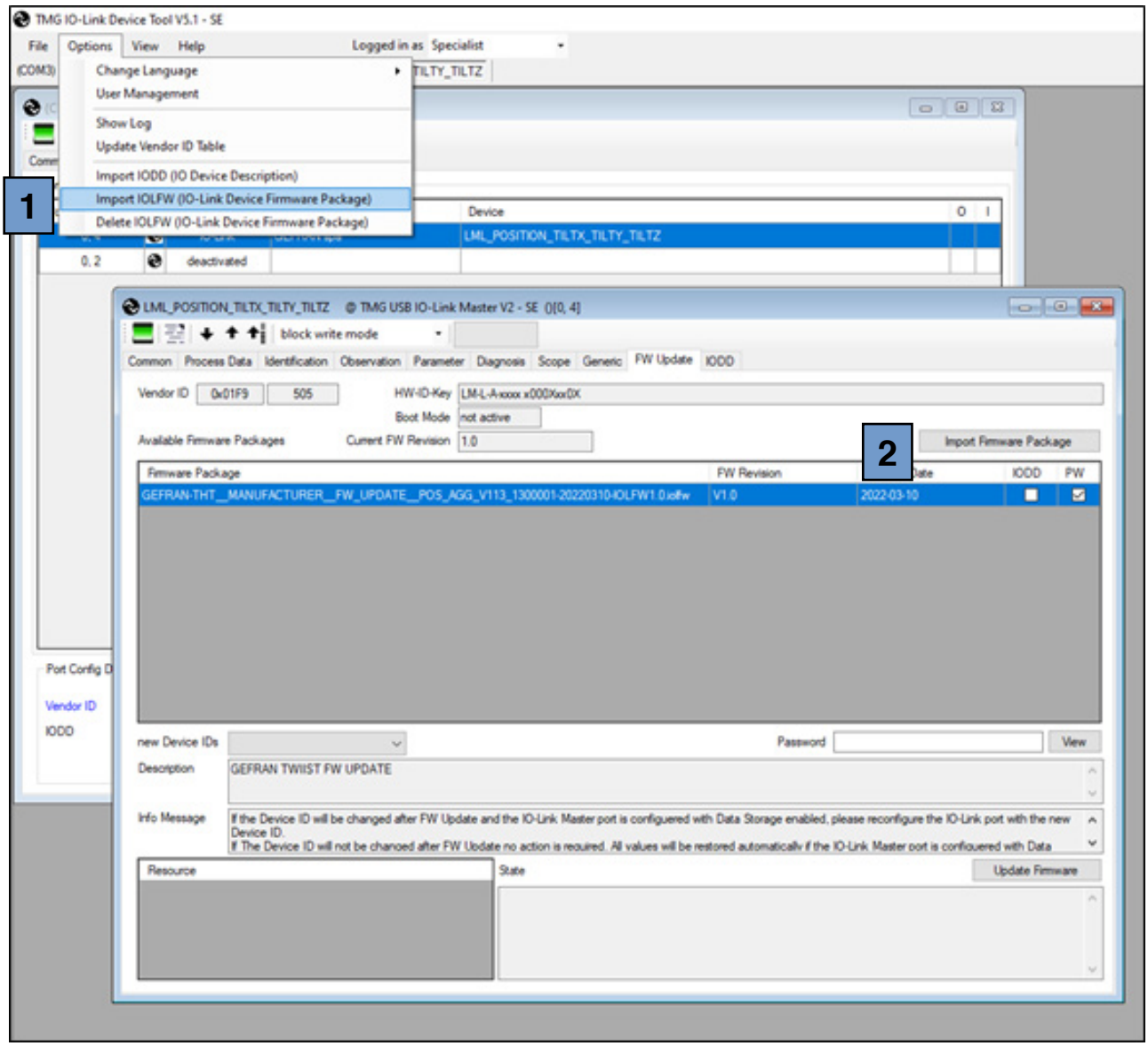


Figure 14. Example of FW update using TMG IO-Link device tool software

Note: TMG IO-Link device tool software is used for the firmware download steps shown in the example.

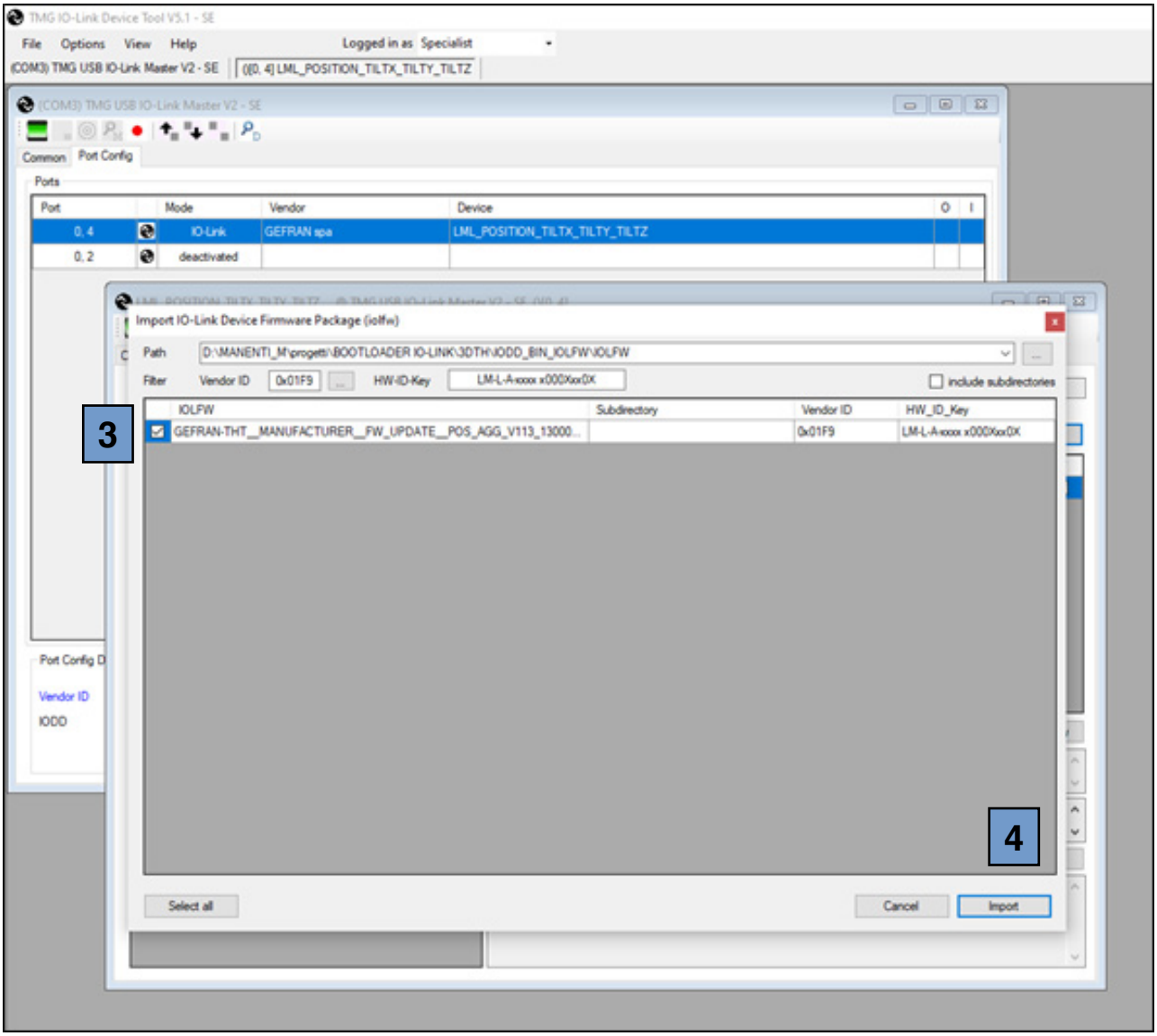


Figure 15. Example of FW update using TMG IO-Link device tool software

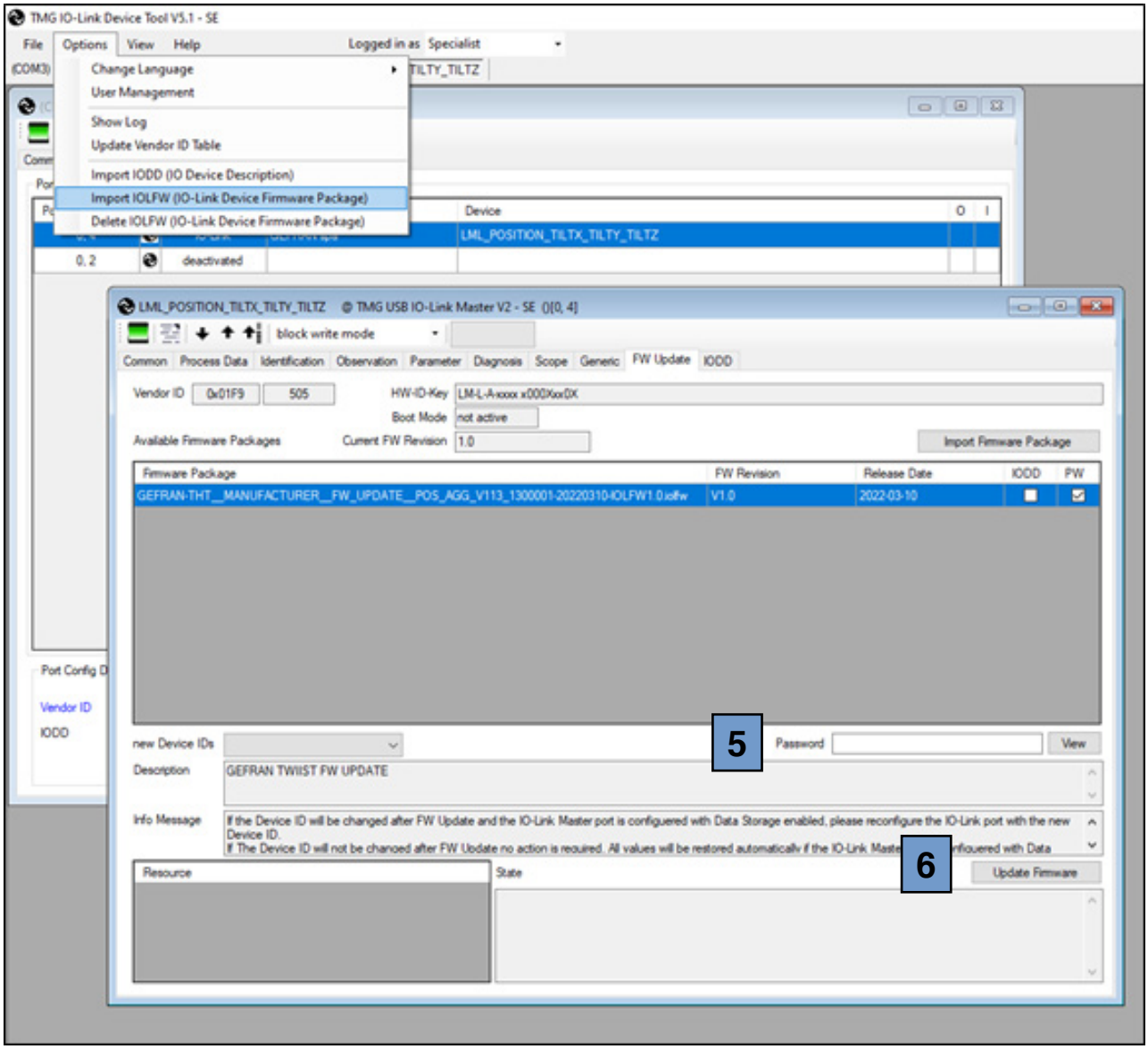


Figure 16. Example of FW update using TMG IO-Link device tool software

GEFRAN

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