

# MSA213K

Magnetic sensor with  IO-Link interface

User manual



## Table of contents

<b>1</b>	<b>General Information</b>	<b>4</b>
1.1	Documentation	4
1.1.1	History	4
1.2	Definitions	4
1.3	Intended use	4
1.4	Switching on the operating voltage	5
<b>2</b>	<b>Optical LED indicator</b>	<b>5</b>
2.1	General	5
2.2	LED display	5
<b>3</b>	<b>Functional Description</b>	<b>6</b>
3.1	Normal Operation	6
3.2	Parameterization	6
3.3	Calibration	6
3.4	Additional functions	7
3.4.1	Direction	7
3.4.2	Offset	7
3.4.3	Negative measuring range	7
3.5	Warnings / Errors	8
3.5.1	Warnings	8
3.5.2	Errors	8
<b>4</b>	<b>Parameter</b>	<b>9</b>
4.1	Process data	9
4.1.1	Status bits	9
4.1.2	Position value (Sensor Measurement)	9
4.2	Standard parameters	9
4.2.1	ZeroPos	9
4.2.2	Direction	10
4.2.3	Offset	10
4.2.4	NegativRange	10
4.2.5	POS	11
4.3	Options	11
4.3.1	SpeedInterface	11
4.4	Device information	12
4.4.1	EEPROM Address	12
4.4.2	EEPROM Data	12
4.4.3	SignalOutput	13
4.4.4	OutputResABS	13
4.4.5	OutputResLD	13
4.4.6	SerialNumber	14
4.4.7	TempEncoder	14

- 5 IO-Link ..... 15**
  - 5.1 Description ..... 15
  - 5.2 Process data ..... 15
  - 5.3 Process data input (device ⇒ master) ..... 16
  - 5.4 Directory of objects ..... 16
    - 5.4.1 IO-Link specific objects..... 16
    - 5.4.2 IO-Link SystemCommands..... 17
    - 5.4.3 IO-Link EventCodes ..... 17
    - 5.4.4 IO-Link ErrorCodes ..... 17
  
- 6 Block diagram ..... 18**

## 1 General Information

### 1.1 Documentation

The following documents describe this product:

- The data sheet describes the technical data, the dimensions, the pin assignment, the accessories and the order key.
- The installation instructions describe the mechanical and electrical installation with all safety-relevant conditions and the associated technical specifications.
- User manual for connecting the display to an IO-Link master and for commissioning.
- IODD file (IO-Link Device Description); with the help of this file, the connection and configuration with an IO-Link master is possible by means of commercially available IO-Link masters and their configurators.

You can also download these documents at <http://www.siko-global.com/p/msa213k>.

#### 1.1.1 History

Mod. status	Date	Description
217/22	December 6, 2022	Document prepared

### 1.2 Definitions

If not explicitly stated otherwise, decimal values are given as figures without an extension (e. g. 1234), binary values are marked after the figure with a "b" (e. g. 1011b), hexadecimal values with an "h" (e. g. 280h).

Individual bits of larger logic units are named with their value after a dot (e. g., PDI.0; process data input bit 0).

### 1.3 Intended use

For the further functional description, normal operation of the system with unchanged factory setting is assumed unless otherwise described.

The present device is a high-resolution, magnetically operating absolute encoder with integrated IO-Link interface. An incremental interface is available optionally as a digital line driver or Vpp signal output. The encoder acquires the absolute and incremental path information of the coded magnetic tape MBA213. The information of the position value (up to 16.3 m) is embodied as an absolute value in the magnetic tape MBA213. A status LED provides information about the operating state as well as about the device and system failures. The absolute position value and the encoder temperature can be queried via the IO-Link interface. In addition, device parameters can be adapted and stored in a non-volatile memory.

## 1.4 Switching on the operating voltage

After the operating voltage is switched on, the device initializes. A system test is performed during initialization, the status LED lights briefly in cyan color, and the device parameters are loaded from the nonvolatile memory into the main memory of the device controller. The LED switches to green after a correct start-up. At first use, the default values are used during initialization. After operating voltage is supplied again or there is a software reset (warm start), the device works with the last saved parameters if they were stored non-volatile. If no error has been detected, the device starts normal operation and can communicate with an IO-Link master.

## 2 Optical LED indicator

### 2.1 General



Fig. 1: Encoder MSA213K with magnetic tape MBA213

### 2.2 LED display

A status LED indicates the operating status of the system.

LED state	Description
green	Sensor ready for operation
blue	Senor/band distance warning
red	Error (sensor plausibility error/internal power supply faulty)
white	Service mode
yellow	Interpolator adjustment
cyan	Bootup indication
magenta	Hall adjustment

Table 1: Status-LED

### 3 Functional Description

#### 3.1 Normal Operation

When the encoder is started, it runs in normal operation. The measured absolute actual value as well as the status bits are made available to the IO-Link master via the interface. A digital line driver or analog 1 Vpp sine/cosine signal is optionally available.

#### 3.2 Parameterization

The MSA213K encoder can be parameterized via the IO-Link interface.

#### 3.3 Calibration

**NOTICE**

Calibration is only possible if the sensor position relative to the tape does not change!

Since the magnetic tape is composed of rolled goods, a zero point must be set in the sensor at the desired position (only then does the sensor count correctly over the entire measuring range of 0 ... 16383999  $\mu\text{m}$ ).

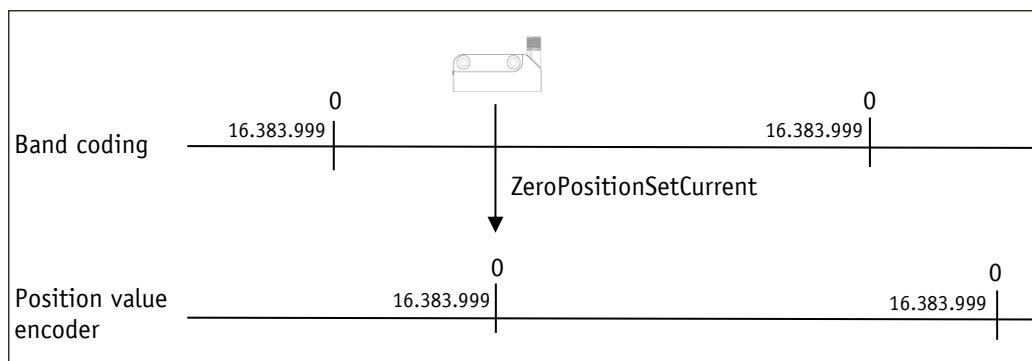


Fig. 2: Calibration

The following step is required to perform a calibration:

- Perform calibration using system command `ZeroPositionSetCurrent` (see chapter 5.4.2)

Due to the absolute measuring system, calibration is only required once during the first system integration of encoder MSA213K and magnetic tape MBA213. During calibration, the calibration value is used to calculate the actual value.

To reset the calibration, the parameter `p212_ZeroPos` must be set to 0, after which the absolute position of the magnetic tape is output again.

### 3.4 Additional functions

#### 3.4.1 Direction

The parameter (p204\_Direction) is used to define the encoder counting direction, since the sensor/tape alignment cannot be changed due to the system.

Changing the count direction also changes the current position value. For example, if the encoder is located at the location 14.000.000 μm, 2.383.999 μm is output after a change in the counting direction:

Sample calculation:

$$\text{Position Reverse [1]} = 16.383.999 - \text{Position Normal [0]}$$

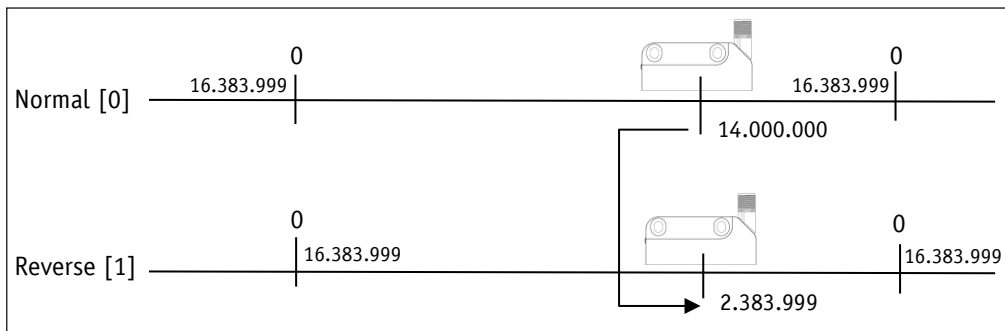


Fig. 3: Direction

#### 3.4.2 Offset

With the Parameter [Offset](#), it is possible to shift the value range. The offset value is added to the position value in the encoder.

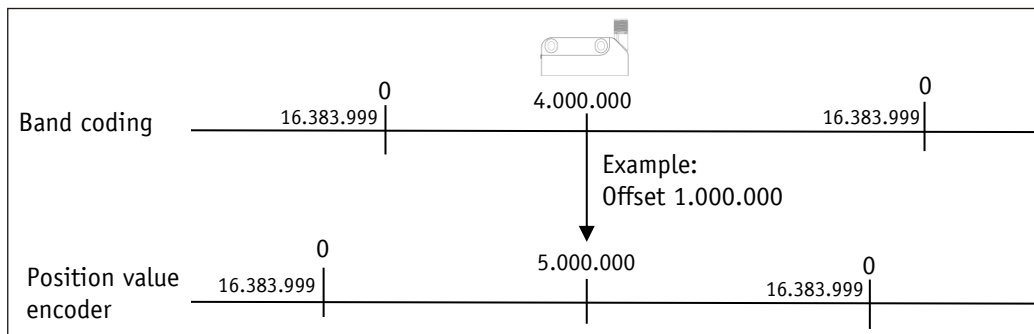


Fig. 4: Offset

#### 3.4.3 Negative measuring range

This parameter [P212\\_NegativRange](#) defines the negative measuring range. This makes it possible to define a negative range in the absolute position.

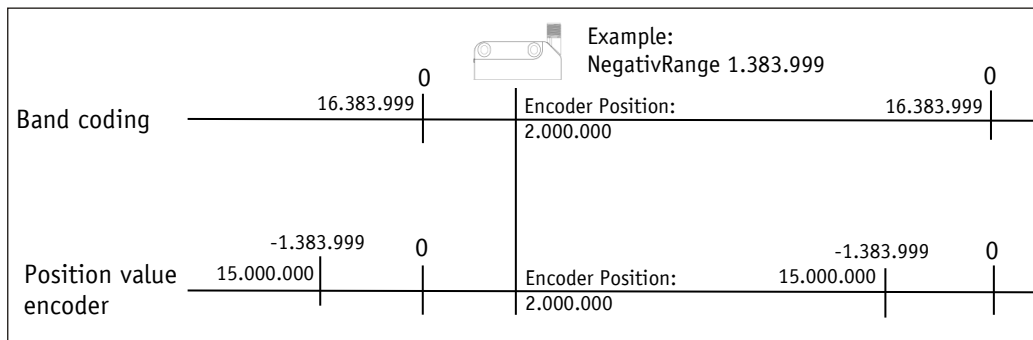


Fig. 5: NegRange

### 3.5 Warnings / Errors

The warnings and errors listed below can be reset with the IO-Link SystemCommands PosInit.

#### 3.5.1 Warnings

Warnings have no influence on the recording of the actual value. Warnings are deleted after removing the cause.

Possible warnings:

- The tape-sensor distance exceeds the limit value  $\Rightarrow$  immediately check or reduce the tape-sensor distance!  
This warning is indicated by a blue status LED (see chapter 2.1). The PDI.1 bit is set via the process data input (see chapter 5.3) of the interface.  
The tape sensor warning can increase the linearity deviation specified in the data sheet.

#### 3.5.2 Errors

Error states are signaled via the status LED (see chapter 2.1) and via the interface.

To return to normal operation, the cause must be removed. The error signaling can then be acknowledged or deleted via the interface.

Possible errors are:

- Sensor plausibility error  $\Rightarrow$  Correct sensor-tape alignment
- Internal power supply faulty  $\Rightarrow$  Check plug connection and cable

These errors are indicated by a red status LED (see chapter 2.1). The PDI.0 bit is set via the process data input (see chapter 5.3) of the interface.



## 4 Parameter

The encoder can be completely parameterized via the IO-Link interface.

Chapter	Starting with page
Process data	9
Standard parameters	9
Options	11
Device information	12

Table 2: Parameters chapter

### 4.1 Process data

#### 4.1.1 Status bits

The status bits are part of the 5 bytes of the process data input (see chapter 5.3).

#### 4.1.2 Position value (Sensor Measurement)

The absolute actual value is part of the 5 bytes of the process data input (see chapter 5.3).

### 4.2 Standard parameters

#### 4.2.1 ZeroPos

General characteristics

EEPROM	yes
Unit	-
Value range	0 ... 16383999
Default	0

IO-Link

Data type	UnsignedInteger32		
Access	rw		
Index	212	Sub-index	0
Data Storage	yes		

### 4.2.2 Direction

General characteristics

EEPROM	yes
Unit	-
Value range	0 ... 1
Default	0

IO-Link

Data type	UnsignedInteger8		
Access	rw		
Index	204	Sub-index	0
Data Storage	yes		

Parameter selection

Value	Description
0	"Normal" travel direction Increasing position values when moving to the connector side.
1	"Reverse" travel direction Decreasing position values when moving to the connector side.

### 4.2.3 Offset

General characteristics

EEPROM	yes
Unit	-
Value range	0 ... 16383999
Default	0

IO-Link

Data type	UnsignedInteger32		
Access	rw		
Index	210	Sub-index	0
Data Storage	yes		

### 4.2.4 NegativRange

General characteristics

EEPROM	yes
Unit	-
Value range	0 ... 16383999
Default	0

## IO-Link

Data type	UnsignedInteger32		
Access	rw		
Index	211	Sub-index	0
Data Storage	yes		

## 4.2.5 POS

## General characteristics

EEPROM	yes
Unit	-
Value range	-16383999 ... 16383999
Default	0

## IO-Link

Data type	Record		
Access	ro		
Index	230	Sub-index	0
Data Storage	no		

Sub-index	1	Name	ABS (Absolute position)
	SignedInteger	Value range	-16383999 ... 16383999
Sub-index	2	Name	QEI (internal counter)
	SignedInteger	Value range	-16383999 ... 16383999
Sub-index	3	Name	DIFF (internal difference)
	SignedInteger	Value range	0 ... 16383999
Sub-index	4	Name	Warning
	Bool	Value range	Ok / Warning
Sub-index	5	Name	Error
	Bool	Value range	Ok / Warning

## 4.3 Options

## 4.3.1 SpeedInterface

## General characteristics

EEPROM	yes
Unit	-
Value range	0 ... 1
Default	0

## IO-Link

Data type	Bool		
Access	rw		
Index	209	Sub-index	0
Data Storage	yes		

## Parameter selection

Value	Description
0 / 1	No influence

## 4.4 Device information

### 4.4.1 EEPROM Address

## General characteristics

EEPROM	yes
Unit	-
Value range	0 ... 1023
Default	-

## IO-Link

Data type	UnsignedInteger16		
Access	rw		
Index	200	Sub-index	0
Data Storage	no		

### 4.4.2 EEPROM Data

## General characteristics

EEPROM	yes
Unit	-
Value range	0 ... 255
Default	-

## IO-Link

Data type	UnsignedInteger8		
Access	ro		
Index	201	Sub-index	0
Data Storage	no		

### 4.4.3 SignalOutput

General characteristics

EEPROM	yes
Unit	-
Value range	0 ... 2
Default	0

IO-Link

Data type	UnsignedInteger8		
Access	ro		
Index	205	Sub-index	0
Data Storage	no		

Parameter selection

Value	Description
0	None – no output circuit
1	LD – Digital output of line driver
2	1 Vpp – Analog output sin/cos

### 4.4.4 OutputResABS

General characteristics

EEPROM	yes
Unit	μm
Value range	0 ... 255
Default	-

IO-Link

Data type	UnsignedInteger8		
Access	ro		
Index	206	Sub-index	0
Data Storage	no		

### 4.4.5 OutputResLD

General characteristics

EEPROM	yes
Unit	-
Value range	0 ... 16383
Default	-

## IO-Link

Data type	UnsignedInteger16		
Access	ro		
Index	207	Sub-index	0
Data Storage	no		

4.4.6 **SerialNumber**

## General characteristics

EEPROM	yes
Unit	-
Value range	-
Default	xxxxxxxx

## IO-Link

Data type	String		
Access	ro		
Index	21	Sub-index	0
Data Storage	no		

4.4.7 **TempEncoder**

## General characteristics

EEPROM	no
Unit	°C
Value range	-128 ... 127
Default	-

## IO-Link

Data type	UnsignedInteger8		
Access	ro		
Index	140	Sub-index	0
Data Storage	no		

## 5 IO-Link

### 5.1 Description

The device description is available for download as IODD at <http://www.siko-global.com/p/msa213k> and in the IODD finder of the IO-Link Community.

IO-Link Version	V1.1
SIO-Mode	No
COM-Mode	COM3 (230.4 kBaud)
Min Cycle Time	800 µs
Process Data In	5 Byte
Process Data Out	0 Byte
Data Storage	Yes
Blockparameter	Yes
Vendor ID	1075
Device ID MSA213K	131072

Table 3: General Interface Information

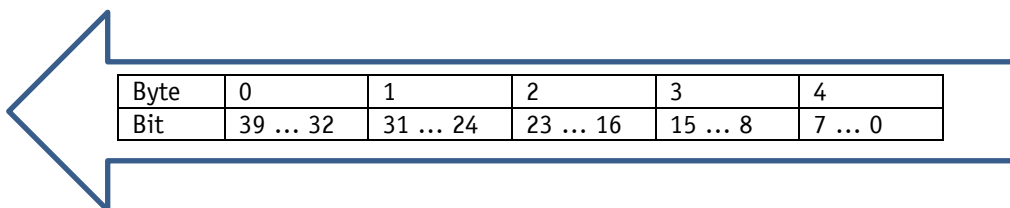
### 5.2 Process data

All process data are displayed within 5 bytes.

#### Transmission sequence:

Byte	0	1	2	3	4	
Sub-index	1				2	3
Bit offset	39 ... 32	31 ... 24	23 ... 16	15 ... 8	1	0
	MSB			LSB		

Table 4: Assignment of transfer sequence, sub-index and bit offset



⇒ Byte 0 is transferred first

Fig. 6: Transmission sequence

### 5.3 Process data input (device ⇒ master)

Sub-index	Name	Bit-offset	Bit-Länge	Data-type	Comment
1	ActualPosition	8	32	Int32	Position value
2	bs01_DistanceWarning	1	1	Bool	Distance warning 0: "Ok" 1: "Warning"
3	bs00_PlausibilityError	0	1	Bool	Plausibility error 0: "Ok" 1: "Error"

Table 5: Process data input

**Structure of process data**

All ports  
Create PLC data type source file

Port	Name	Data type	Address
1	PDIN - SensorMeasurement	IntegerT	(I) 0.0 - 2.7 / 3.6 - 3.7
1	PDIN - Plausibility Error	BooleanT	(I) 3.0
1	PDIN - Distance Warning	BooleanT	(I) 3.1

Fig. 7: Example representation in IO-Link master

### 5.4 Directory of objects

#### 5.4.1 IO-Link specific objects

Index (hex)	Name	Type	Length	Access	Default	Comment
13 (0Dh)	ProfileCharacteristic	String	2 Byte	ro	0x40 0x00	See IO-Link Interface Spec.
14 (0Eh)	PDInputDescriptor	String	6 Byte	ro	0x01 0x02 0x00 0x03 0x1A 0x06	See IO-Link Interface Spec.
16 (10h)	VendorName	String		ro	SIKO GmbH	
17 (11h)	VendorText	String		ro	www.siko-global.com	
18 (12h)	ProduktName	String		ro	MSA213K	
20 (14h)	ProduktText	String		ro	Magnetic Absolut Encoder Linear	
21 (15h)	SerialNumber	String		ro		
22 (16h)	HardwareRevision	String		ro		
23 (17h)	FirmwareRevision	String		ro		



Index (hex)	Name	Type	Length	Access	Default	Comment
24 (18h)	ApplicationSpecific Tag	String	32 Byte	rw	***	See IO-Link Interface Spec.
25 (19h)	Function Tag	String	32 Byte	rw	***	See IO-Link Interface Spec.
26 (1Ah)	Location tag	String	32 Byte	rw	***	See IO-Link Interface Spec.
36 (24h)	DeviceStatus	Uint8	1 Byte	ro	0	See IO-Link Interface Spec.

Table 6: IO-Link specific indexes

#### 5.4.2 IO-Link SystemCommands

Index (hex)	Name	Access	Value	Name	Comment
2 (02h)	SystemCommands	wo	128	Device Rese	See IO-Link Interface Spec.
			129	Application Reset	
			130	Back-to-box	
			192	ZeroPositionSetCurrent	Manufacturer
			208	PosInit	

Table 7: SystemCommands

#### 5.4.3 IO-Link EventCodes

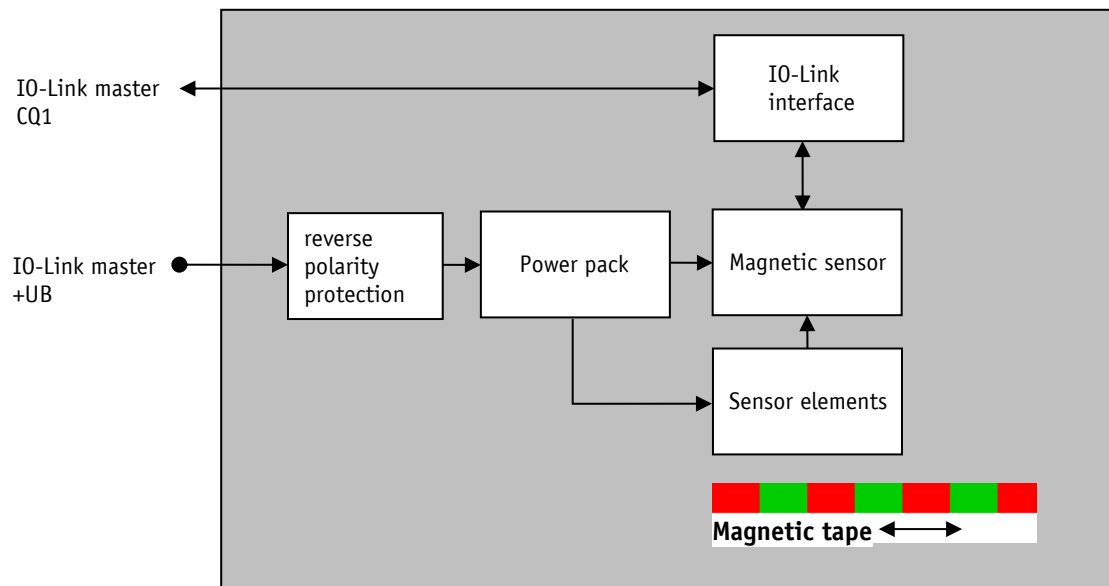
Value	Name	Type	Comment
36350 (8DFEh)	Test Event A	Error	
36351 (8DFFh)	Test Event B	Error	

Table 8: EventCodes

#### 5.4.4 IO-Link ErrorCodes

Value 1 <sup>st</sup> byte	Value 2 <sup>nd</sup> byte	Name	Comment
80h	xxh	Error Code	IO-Link Spec. V1.1.3 Annex D
	00h	Device application error, no details	
	11h	Index not available	
	12h	Subindex not available	
81h	xxh	Vendor specific error code	

Table 9: ErrorCodes

**6 Block diagram***Fig. 8: Block diagram*



**SIKO GmbH**

Weihermattenweg 2  
79256 Buchenbach

**Phone**

+ 49 7661 394-0

**Fax**

+ 49 7661 394-388

**E-Mail**

[info@siko-global.com](mailto:info@siko-global.com)

**Internet**

[www.siko-global.com](http://www.siko-global.com)

**Service**

[support@siko-global.com](mailto:support@siko-global.com)