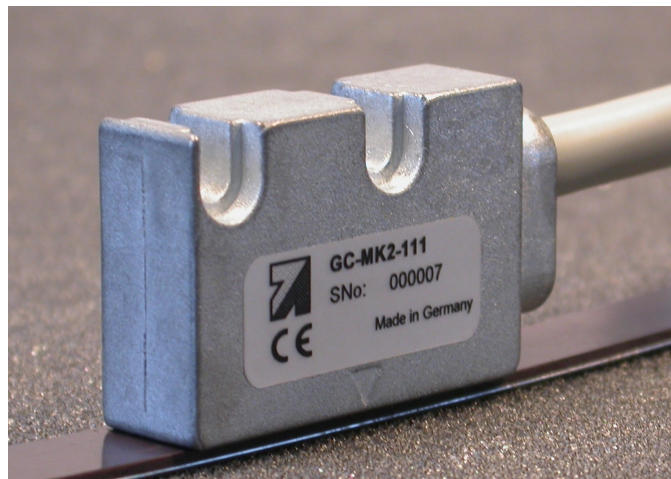


Magnetic Measuring Systems



User Manual ***incl.*** ***Mounting Instruction***

Version: 1.4
Date: 10.08.2007

GEMAC mbH · Zwickauer Straße 227 · 09116 Chemnitz · Germany
Telephone: +49 371 3377 – 0 · Telefax: +49 371 3377 – 272
eMail: interpolation@gemac-chemnitz.de · Web: www.gemac-chemnitz.de

Revision History

<i>Datum</i>	<i>Revision</i>	<i>Changes</i>
22.05.2006	1.0	First Version
22.06.2006	1.1	Mounting Instruction added
22.08.2006	1.3	Order matrix added
10.08.2007	1.4	Analogue types added

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1 Overview

The magnetic measuring systems of the GC-MK-series are suitable for linear position detection. The systems are incremental systems. The maximum reachable resolution depends on the configuration and will be up to $1\mu\text{m}$ with those systems. So an absolute accuracy of $10\mu\text{m}$ is possible. At the same time the repeatability is also $1\mu\text{m}$.

The contactless measuring principle makes the systems suitable for high dynamic processes in drive applications. The main advantages against the more expensive optical systems is the insensitiveness to dust. So the measuring systems can be used in dirty environments.

The modular structure of the GC-MK-series makes the mounting and using very easy. The magnetic scale will be mounted with double-side adhesive tape directly to the machine. The signal conditioning and processing which is integrated in the read head allows an easy and comfortable installation to be done.

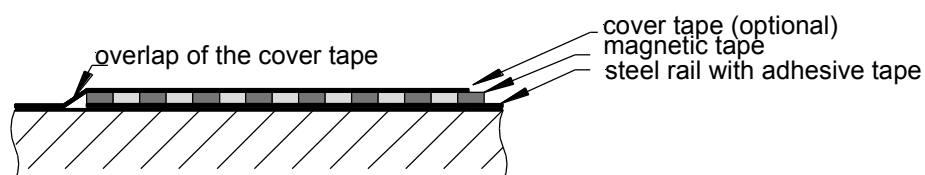
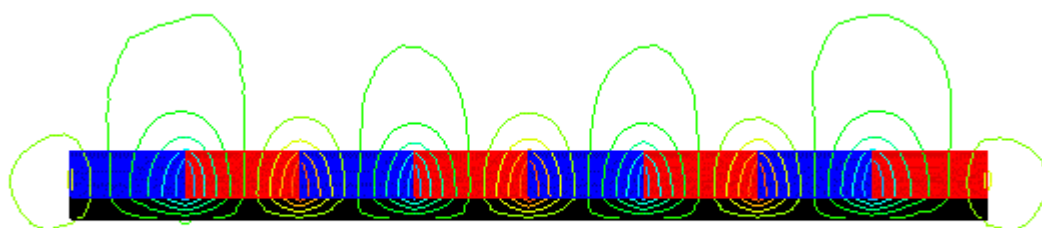
The system provides square waves via a standardised RS422 interface. It is possible to get the read head with modified edge distances for adapting to slower counters.

2 Magnetic Tape

The magnetic tape is the scale of the system. It is magnetised in defined distances. The basis material is an elastomer tape which is very resistant against high temperatures and several chemical substances. It is mounted on a high-grade steel tape. This combination can be used in machine tooling. The linear expansion coefficient is nearly the same as steel.

An additional high-grade steel cover tape makes the mechanical protection complete. The cover tape is optional.

Both tapes will be mounted by a preinstalled double-side adhesive tape.



3 Magnetic Read Head GC-MK1

The magnetic information of the scale GC-MB1 will be detected by the read head contact less. An integrated interpolation IC makes a resolution of up to 1µm possible. Via an RS422 interface the length information will be provided for a further processing.

Features:

- Pole length 1mm
- Different resolutions available
- Different edge distances available
- Metal case
- Degree of protection IP67



Technical Parameter

Power Supply	5VDC
Output Signals	RS422
Connetor	Standard without connector Sub-D15 male connector optional
Degree of Protection	IP67
Temperature Range	-20 to +85°C
Housing	Metall
Cable Length	1m *

Table 1

*different on demand

Resolution	Standard 1µm ; optional 2µm, 5µm, 10µm
Min. Edge Distance	Standard 250ns ; optional 500ns, 1µs, 2µs, 4µs, 8µs
System Accurcay	± (0,04 + 0,001)mm/m (magnetisation accuracy + interpolation error)
Repeatability	±1Increment
Max. Velocity	max. 25m/s

Table 2

Maximum Velocity in Dependence on Resolution and Edge Distance

GC-MK1		Minimum Edge Distance					
		1	2	4	8	16	32
		250ns	500ns	1µs	2µs	4µs	8µs
Resolution	1µm	3,4	1,7	0,8	0,4	0,2	0,1
	2µm	6,8	3,4	1,7	0,8	0,4	0,2
	5µm	17,2	8,6	4,3	2,1	1,0	0,5
	10µm	25	17,2	8,6	4,3	2,1	1,0

Table 3

Output Signals

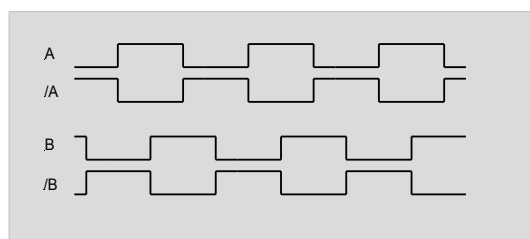


Figure1

Adapting to a Counter

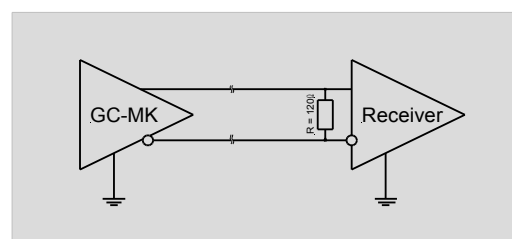


Figure 2

4 Magnetic Read Head GC-MKA1

The magnetic information of the scale GC-MB1 will be detected by the read head contact less. Via an analogue 1Vpp interface the length information will be provided for a further processing.

Features:

- Pole length 1mm
- 1Vpp, differential
- Metal case
- Degree of protection IP67



Technical Parameter

Power Supply	5VDC
Output Signals	1Vpp
Connetor	Standard without connector Sub-D15 male connector optional
Degree of Protection	IP67
Temperature Range	-20...+85°C
Housing	Metal
Cable Length	1m *

Table 4

*different on demand

Output Signals

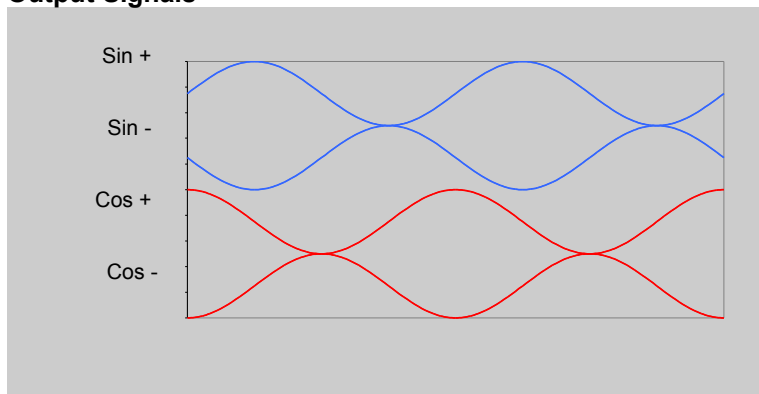


Figure 3

5 Magnetic Read Head GC-MK401

The magnetic information of the scale GC-MB1 will be detected by the read head contact less. An integrated interpolation IC makes a resolution of up to 25µm possible. Via an RS422 interface the length information will be provided for a further processing.

Features:

- Pole length 1mm
- Different resolutions available
- Metal case
- Degree of protection IP67



Technical Parameter

Power Supply	5VDC
Output Signals	RS422
Connetor	Standard without connector Sub-D15 male connector optional
Degree of Protection	IP67
Temperature Range	-20 to +85°C
Housing	Metall
Cable Length	1m *

Table 5
*different on demand

Resolution	Standard 25µm ; optional 50µm, 125µm, 250µm
Edge Distance	33ns
System Accurcay	± (0,04 + 0,025)mm/m (magnetisation accuracy + interpolation error)
Repeatability	±1Increment
Max. Velocity	max. 25m/s

Table 6

Output Signals

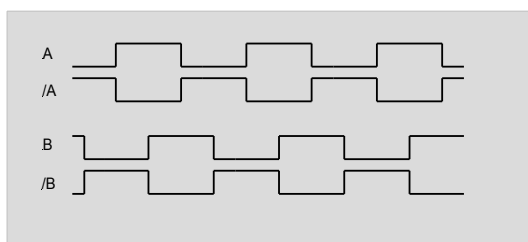


Figure4

Adapting to a Counter

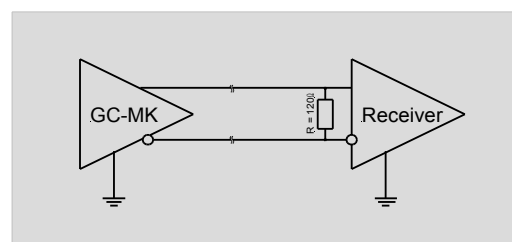


Figure 5

6 Magnetic Tape GC-MB1

Basic Features

- Suitable for the read heads GC-MK1 and GC-MK401
- Elastomer film on CrNi 17 7 high grade steel
- Insensitive against corrosion
- High temperature stability
- Insensitive against several chemical substances

Technical Parameter

Pole Length	1mm
Width	10mm
Length	Standard 30m, max. 100m
Accuracy Class	±40µm/m
Linear Expansion Coefficient	$(11 \pm 1) \times 10^{-6}/K$
Material	Elastomer Metal Bond
Operating Temperature Range	-40°C to +120°C
Storage Temperature Range	-40°C to +120°C

Table 7

Distance Sensor – Tape	Max. 0.5mm
Cover Tape*	High Grade Steel
Mounting	adhesive sealing

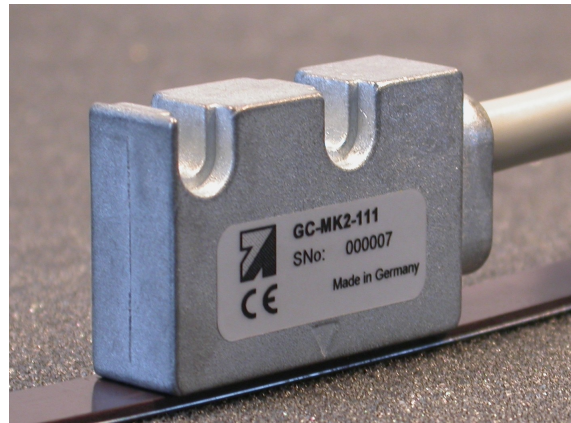
Table 8

7 Magnetic Read Head GC-MK2

The magnetic information of the scale GC-MB2 will be detected by the read head contact less. An integrated interpolation IC makes a resolution of up to 2µm possible. Via an RS422 interface the length information will be provided for a further processing.

Features:

- Pole length 2mm
- Different resolutions available
- Different edge distances available
- Metal case
- Degree of protection IP67



Technical Parameter

Power Supply	5VDC
Output Signals	RS422
Connetor	Standard without connector Sub-D15 male connector optional
Degree of Protection	IP67
Temperature Range	-20 to +85°C
Housing	Metall
Cable Length	1m *

Table 9

*different on demand

Resolution	Standard 2µm ; optional 4µm, 10µm, 20µm
Min. Edge Distance	Standard 250ns ; optional 500ns, 1µs, 2µs, 4µs, 8µs
System Accurcay	± (0,04 + 0,002)mm/m (magnetisation accuracy + interpolation error)
Repeatability	±1Increment
Max. Velocity	max. 25m/s

Table 10

Maximum Velocity in Dependence on Resolution and Edge Distance

GC-MK2		Minimum Edge Distance					
		1	2	4	8	16	32
		250ns	500ns	1µs	2µs	4µs	8µs
Resolution	2µm	6,8	3,4	1,7	0,8	0,4	0,2
	4µm	13,7	6,8	3,4	1,7	0,8	0,4
	10µm	25	17,2	8,6	4,3	2,1	1,0
	20µm	25	25	17,2	8,6	4,3	2,1

Table 11

Output Signals

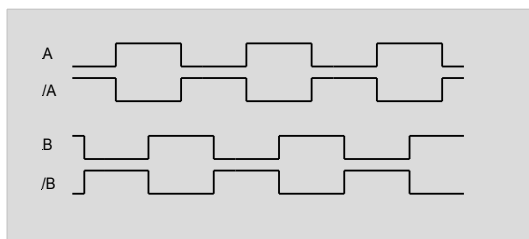


Figure6

Adapting to a Counter

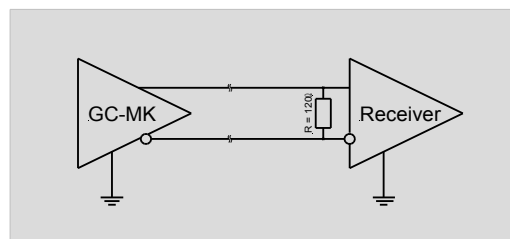


Figure 7

8 Magnetic Read Head GC-MKA2

The magnetic information of the scale GC-MB2 will be detected by the read head contact less. Via an analogue 1Vpp interface the length information will be provided for a further processing.

Features:

- Pole length 2mm
- 1Vpp, differential
- Metal case
- Degree of protection IP67



Technical Parameter

Power Supply	5VDC
Output Signals	1Vpp
Connetor	Standard without connector Sub-D15 male connector optional
Degree of Protection	IP67
Temperature Range	-20...+85°C
Housing	Metal
Cable Length	1m *

Table 12

*different on demand

Output Signals

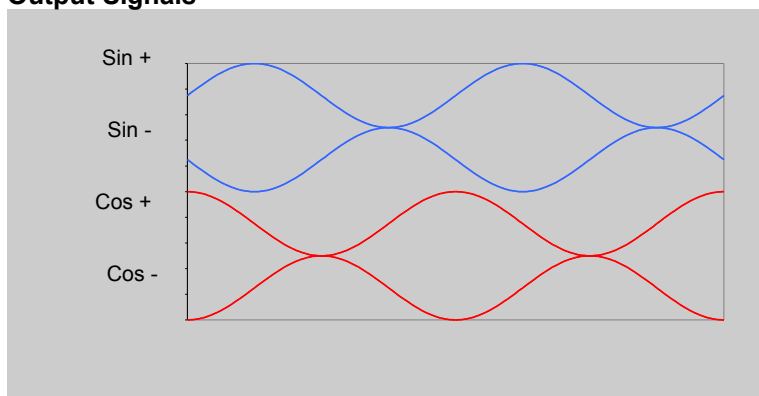


Figure 8

9 Magnetic Read Head GC-MK402

The magnetic information of the scale GC-MB1 will be detected by the read head contact less. An integrated interpolation IC makes a resolution of up to 50µm possible. Via an RS422 interface the length information will be provided for a further processing.

Features:

- Pole length 2mm
- Different resolutions available
- Metal case
- Degree of protection IP67



Technical Parameter

Power Supply	5VDC
Output Signals	RS422
Connetor	Standard without connector Sub-D15 male connector optional
Degree of Protection	IP67
Temperature Range	-20 to +85°C
Housing	Metall
Cable Length	1m *

Table 13

*different on demand

Resolution	Standard 50µm ; optional 100µm, 250µm, 500µm
Min. Edge Distance	Standard 33ns
System Accurcay	± (0,04 + 0,05)mm/m (magnetisation accuracy + interpolation error)
Repeatability	±1Increment
Max. Velocity	max. 25m/s

Table 14

Output Signals

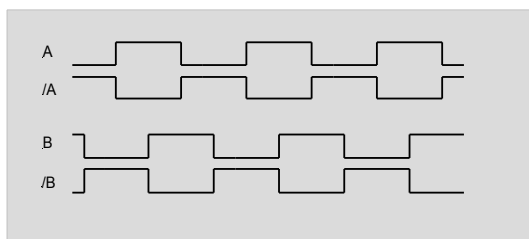


Figure9

Adapting to a Counter

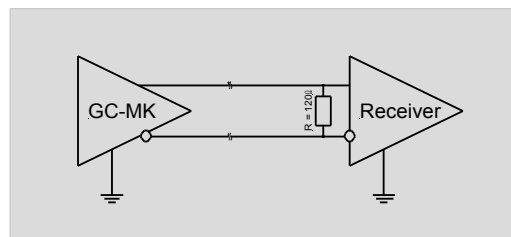


Figure 10

10 Magnetic Tape GC-MB2

Basic Features

- Suitable for the read heads GC-MK1 and GC-MK401
- Elastomer film on CrNi 17 7 high grade steel
- Insensitive against corrosion
- High temperature stability
- Insensitive against several chemical substances

Technical Parameter

Pole Length	2mm
Width	10mm
Length	Standard 30m, max. 100m
Accuracy Class	$\pm 40\mu\text{m}/\text{m}$
Linear Expansion Coefficient	$(11\pm 1) \times 10^{-6}/\text{K}$
Material	Elastomer Metal Bond
Operating Temperature Range	-40°C to +120°C
Storage Temperature Range	-40°C to +120°C

Table 15

Distance Sensor – Tape	max. 1mm
Cover Tape*	High Grade Steel
Mounting	adhesive sealing

Table 16

11 Magnetic Read Head GC-MK5

The magnetic information of the scale GC-MB1 will be detected by the read head contact less. An integrated interpolation IC makes a resolution of up to 5µm possible. Via an RS422 interface the length information will be provided for a further processing.

Features:

- Pole length 5mm
- Different resolutions available
- Different edge distances available
- Metal case
- Degree of protection IP67



Technical Parameter

Power Supply	5VDC
Output Signals	RS422
Connetor	Standard without connector Sub-D15 male connector optional
Degree of Protection	IP67
Temperature Range	-20 to +85°C
Housing	Metall
Cable Length	1m *

Table 17
*different on demand

Resolution	Standard 5µm ; optional 10µm, 25µm, 50µm
Min. Edge Distance	Standard 250ns ; optional 500ns, 1µs, 2µs, 4µs, 8µs
System Accurcay	± (0,04 + 0,005)mm/m (magnetisation accuracy + interpolation error)
Repeatability	±1Increment
Max. Velocity	max. 25m/s

Table 11

Maximum Velocity in Dependence on Resolution and Edge Distance

GC-MK5		Minimum Edge Distance					
		1	2	4	8	16	32
		250ns	500ns	1µs	2µs	4µs	8µs
Resolution	5µm	17,2	8,6	4,3	2,1	1,0	0,5
	10µm	25	17,2	8,6	4,3	2,1	1,0
	25µm	25	25	21,5	10,7	5,3	2,6
	50µm	25	25	25	21,5	10,7	5,3

Table 12

Output Signals

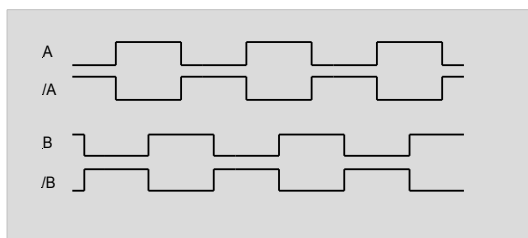


Figure13

Adapting to a Counter

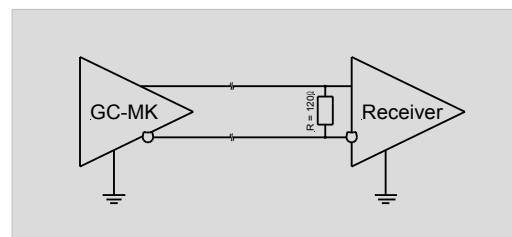


Figure 14

12 Magnetic Read Head GC-MKA5

The magnetic information of the scale GC-MB5 will be detected by the read head contact less. Via an analogue 1Vpp interface the length information will be provided for a further processing.

Features:

- Pole length 5mm
- 1Vpp, differential
- Metal case
- Degree of protection IP67



Technical Parameter

Power Supply	5VDC
Output Signals	1Vpp
Connetor	Standard without connector Sub-D15 male connector optional
Degree of Protection	IP67
Temperature Range	-20...+85°C
Housing	Metal
Cable Length	1m *

Table 18

*different on demand

Output Signals

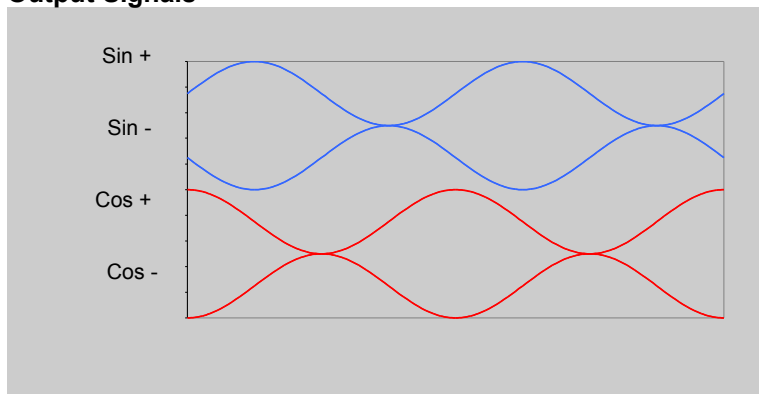


Figure 15

13 Magnetic Read Head GC-MK405

The magnetic information of the scale GC-MB1 will be detected by the read head contact less. An integrated interpolation IC makes a resolution of up to 125µm possible. Via an RS422 interface the length information will be provided for a further processing.

Features:

- Pole length 5mm
- Different resolutions available
- Metal case
- Degree of protection IP67



Technical Parameter

Power Supply	5VDC
Output Signals	RS422
Connetor	Standard without connector
	Sub-D15 male connector optional
Degree of Protection	IP67
Temperature Range	-20 to +85°C
Housing	Metall
Cable Length	1m *

Table 19
*different on demand

Resolution	Standard 125µm ; optional 250µm, 625µm, 1250µm
Min. Edge Distance	Standard 33ns
System Accurcay	± (0,04 + 0,125)mm/m (magnetisation accuracy + interpolation error)
Repeatability	±1Increment
Max. Velocity	max. 25m/s

Table 20

Output Signals

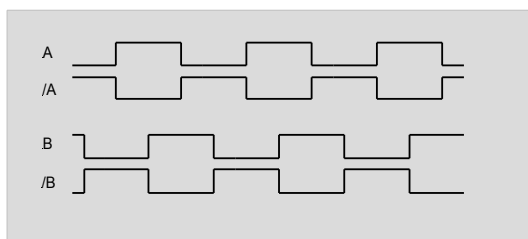


Figure16

Adapting to a Counter

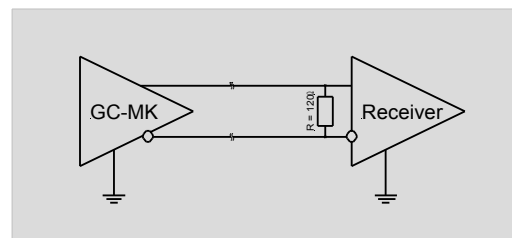


Figure 17

14 Magnetic Tape GC-MB5

Basic Features

- Suitable for the read heads GC-MK1 and GC-MK401
- Elastomer film on CrNi 17 7 high grade steel
- Insensitive against corrosion
- High temperature stability
- Insensitive against several chemical substances

Technical Parameter

Pole Length	5mm
Width	10mm
Length	Standard 30m, max. 100m
Accuracy Class	±40µm/m
Linear Expansion Coefficient	$(11\pm 1) \times 10^{-6}/K$
Material	Elastomer Metal Bond
Operating Temperature Range	-40°C to +120°C
Storage Temperature Range	-40°C to +120°C

Table 21

Distance Sensor – Tape	Max. 2.5mm
Cover Tape*	High Grade Steel
Mounting	adhesive sealing

Table 22

15 Order Matrix

15.1 GC-MK1, GC-MK2, GC-MK5

GC-MK1

	250ns	500ns	1 μ s	2 μ s	4 μ s	8 μ s	16 μ s	32 μ s
10 μ m	1	2	3	4	5	6	7	8
8 μ m	9	10	11	12	13	14	15	16
5 μ m	17	18	19	20	21	22	23	24
4 μ m	25	26	27	28	29	30	31	32
2,5 μ m	33	34	35	36	37	38	39	40
2 μ m	41	42	43	44	45	46	47	48
1,25 μ m	49	50	51	52	53	54	55	56
1 μ m	57	58	59	60	61	62	63	64

GC-MK2

	250ns	500ns	1 μ s	2 μ s	4 μ s	8 μ s	16 μ s	32 μ s
20 μ m	1	2	3	4	5	6	7	8
16 μ m	9	10	11	12	13	14	15	16
10 μ m	17	18	19	20	21	22	23	24
8 μ m	25	26	27	28	29	30	31	32
5 μ m	33	34	35	36	37	38	39	40
4 μ m	41	42	43	44	45	46	47	48
2,5 μ m	49	50	51	52	53	54	55	56
2 μ m	57	58	59	60	61	62	63	64

GC-MK5

	250ns	500ns	1 μ s	2 μ s	4 μ s	8 μ s	16 μ s	32 μ s
50 μ m	1	2	3	4	5	6	7	8
40 μ m	9	10	11	12	13	14	15	16
25 μ m	17	18	19	20	21	22	23	24
20 μ m	25	26	27	28	29	30	31	32
12,5 μ m	33	34	35	36	37	38	39	40
10 μ m	41	42	43	44	45	46	47	48
6,25 μ m	49	50	51	52	53	54	55	56
5 μ m	57	58	59	60	61	62	63	64

Standardtype

on request

Example for GC-MK2:

Resolution: 4 μ m

Edge distance: 1 μ s

→ Order numberr **PR-47020-00 # 43**

16 Connection

16.1 GC-MK1, GC-MK2, GC-MK5 – without connector

Colour of Wire	Description
brown	AP
green	AN
grey	BP
pink	BN
yellow	RP*
red	RN*
black	Error*
blue	+5VDC
white	0V

Table 23

* depends on the configuration

16.2 GC-MK1, GC-MK2, GC-MK5 – with 15 pin Sub-D connector

Pining	Description	Colour of Wire
1	AP	brown
2	0V	white
3	BP	grey
4	+5VDC	blue
5		
6		
7	RN*	red
8		
9	AN	green
10		
11	BN	pink
12		
13	Error	black
14	RP*	yellow
15		

Table 24

* depends on the configuration

Attention!

A sensor destruction may happen in case of a wrong pin assignment !

16.3 GC-MK401, GC-MK402, GC-MK405 – without connector

Colour of Wire	Description
brown	AP
green	AN
grey	BP
pink	BN
yellow	RP*
red	RN*
black	
blue	+5VDC
white	0V

Table 25

* depends on the configuration

16.4 GC-MK401, GC-MK402, GC-MK405 – with 15 pin Sub-D connector

Pining	Description	Colour of Wire
1	AP	brown
2	0V	white
3	BP	grey
4	+5VDC	blue
5		
6		
7	RN*	red
8		
9	AN	green
10		
11	BN	pink
12		
13	Error	black
14	RP*	yellow
15		

Table 26

* depends on the configuration

Attention!*A sensor destruction may happen in case of a wrong pin assignment !*

16.5 GC-MKA1, GC-MKA2, GC-MKA5 – without connector

Colour of Wire	Description
brown	SINP
green	SINN
grey	COSP
pink	COSN
blue	+5VDC
white	0V

Table 27

* depends on the configuration

16.6 GC-MKA1, GC-MKA2, GC-MKA5 – with 15 pin Sub-D connector

Pining	Description	Colour of Wire
1	SINP	brown
2	0V	withe
3	COSP	grey
4	+5VDC	blue
5		
6		
7		
8		
9	SINN	green
10		
11	COSN	pink
12		
13		
14		
15		

Table 28

* depends on the configuration

Attention!*A sensor destruction may happen in case of a wrong pin assignment !*

17 Mechanical Dimensions

17.1 Read Head

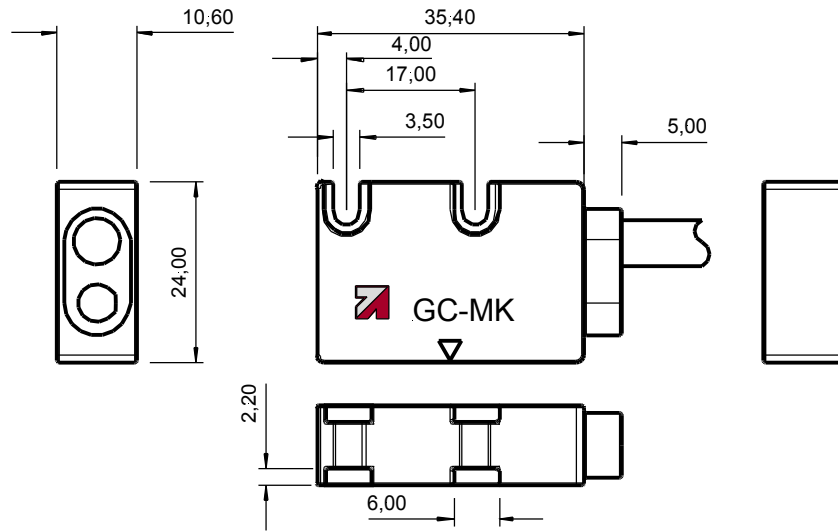


Figure 18
All Dimensions are in mm.

17.2 Magnetic Tape

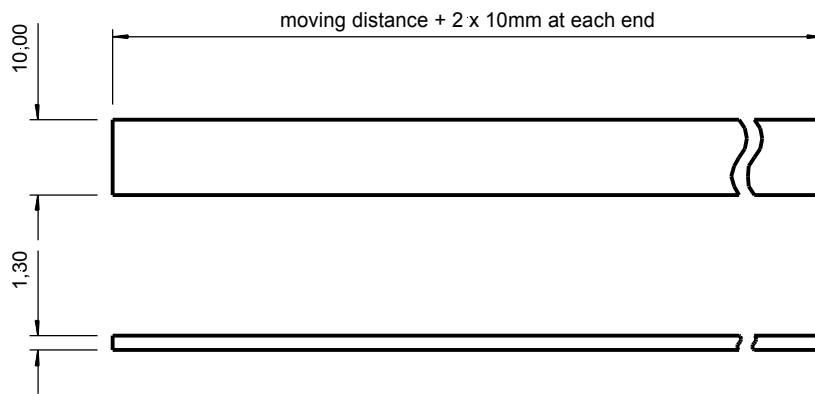


Figure 19
All Dimensions are in mm.

18 Mounting Instruction

18.1 Overview

The following description is suitable for the safe installation and usage of magnetic read head GC-MK in combination with the magnetic scale GC-MB. The components can be used for assembling a magnetic measuring system. This can be an rotational or linear one. The measuring unit is suitable for industrial applications. Due to its robust structure and also its magnetic working principle it can be used in dusty areas.

The read head includes a signal processing unit and provides square wave signals at the output via an RS422 interface.

For a guaranteed function it is essential that the sensor meets the right magnetic scale.

Magnetic Head	Magnetic Scale	Maximum Resolution	Maximum Air Gap
GC-MK1	GC-MB1	1 μm	0,5 mm
GC-MK2	GC-MB2	2 μm	1 mm
GC-MK5	GC-MB5	5 μm	2,5 mm
GC-MK401	GC-MB1	25 μm	0,5 mm
GC-MK402	GC-MB2	50 μm	1 mm
GC-MK405	GC-MB5	125 μm	2,5 mm

18.2 General Hints

To install a safe electrical system the following hints are important:

- The mounting area needs to have the right degree of protection
- Protect the read head against strong shock
- Do not bend the cable
- Electrical connection according to the EMC directive
- Keep the cable length as short as possible
- Clearance distance of sensor and cable connection to noisy fields which occurs from frequency converters, drives or other high current applications
- A use of the shield line is recommend.
- Temperature range -20°C ... $+85^{\circ}\text{C}$ (out of this range no guaranteed function)
- Observe maximum air gap

Attention!

A sensor destruction may happen in case of a wrong pin assignment !

19 Mounting

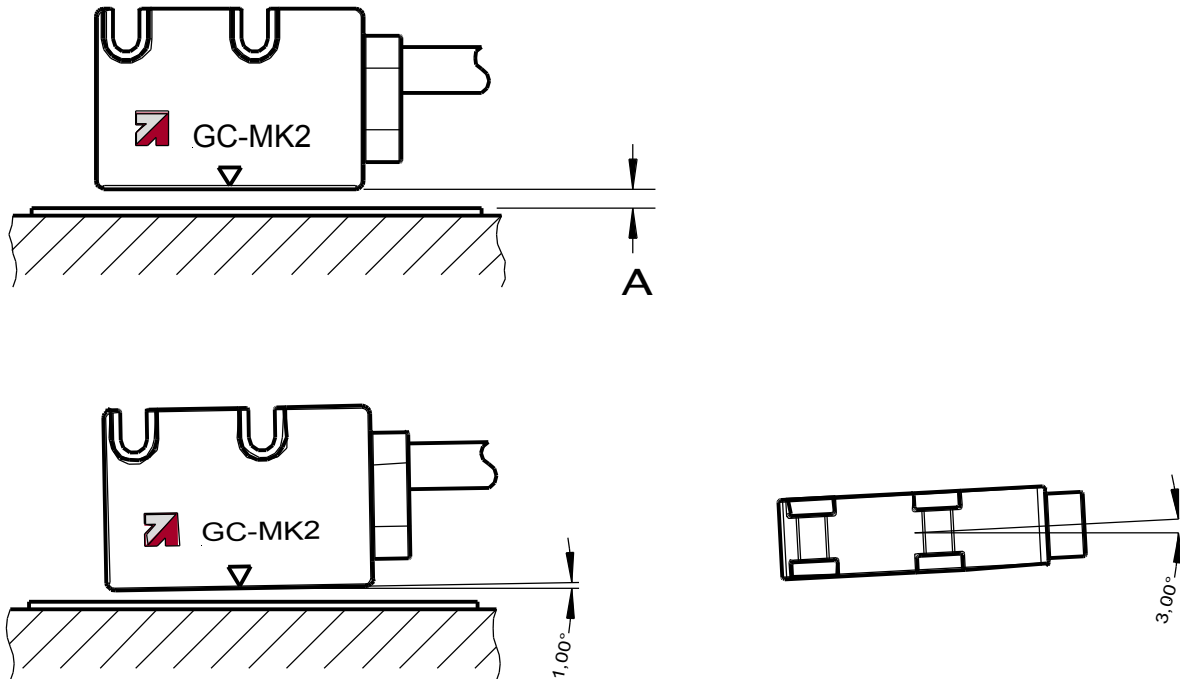
19.1 Read Head

General

The mounting of the read head will be done with two screws M3 at the mounting holes. The slotted holes make the adjustment easier. The maximum tolerances are shown in the following figures. Die air gap is described as **A**.



For getting an optimal measuring result the tolerances have to meet during all the measurement range.



19.2 Magnetic Tape

General

The magnetic tape consist of a magnetisable elastomer and a steel rail whose were combined. It can easy be cut with an metal cutter.



Notice that due to inhomogeneities occurring at both ends of the magnetic tape the tape have to be 10mm longer at each side.

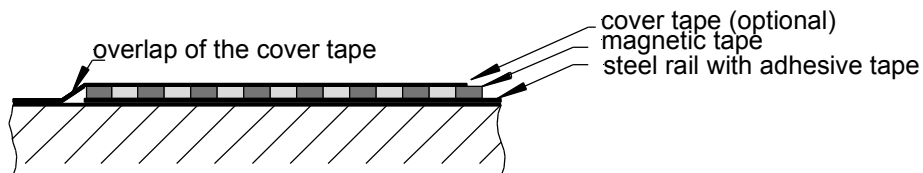
Mounting of the magnetic tape

The magnetic tape will be mount to the surface using the adhesive tape at the bottom side. The surface have to be free of dust, oil and fat. Because these materials influence the durability.

To protect the tape against sharp pieces a cover shield can be ordered optional. It should overlap the magnetic tape at each end.



For cleaning of the surface clear evaporate cleaners should be used. The optimal temperature range for mounting is 20°C.



20 Display Units for Magnetic Read Heads

20.1 AZ1000 – Multifunctional Counter for Incremental Encoders

Features:

- High-speed counter and display unit for incremental encoders
- Maximum input frequency 40MHz
- Desktop unit with carry handle
- Several option modules available
- Sensor interfaces RS422, 1Vpp, 11µA
- Communication to PC via USB or RS232
- 8-digit display for measured value
- Integrated power supply 230 VAC



Technical Parameters:

General Parameters	
Option modules High speed counter Interpolation module IPM1000 Interpolation module IPM200 Without module	square wave signals RS422 / max. input frequency = 40 MHz 1Vpp, (11µA on request) / max. input frequency = 110 kHz 1Vpp, (11µA on request) / max. input frequency = 400 kHz for GEMAC-Magnetic Sensors
Interface	USB, RS232
Power supply	230VAC
Power consumption	4W
Display	8 digits, 9mm
Dimensions	approx. 200 x 150 x 140 mm
Degree of protection	IP20
Working temperature range	0...+70°C
Storage temperature range	-20...+85°C

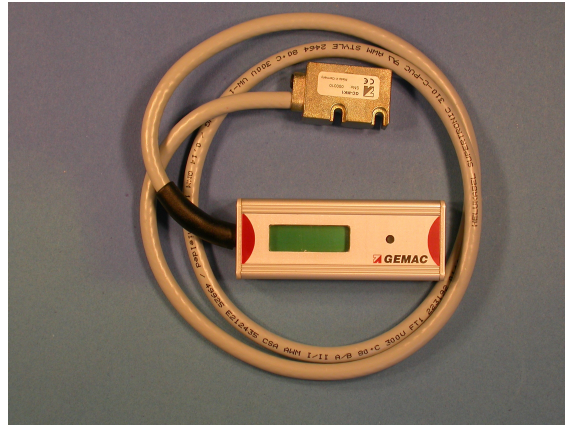
Menu Functions

- Selectable unit mm, inch, degree, increments
- Display resolution
- Grid adjustment
- Adjustable counting direction
- Reference point processing
- Offset
- Trigger
- Counter mode
- Contrast
- Interface configuration
- Reset

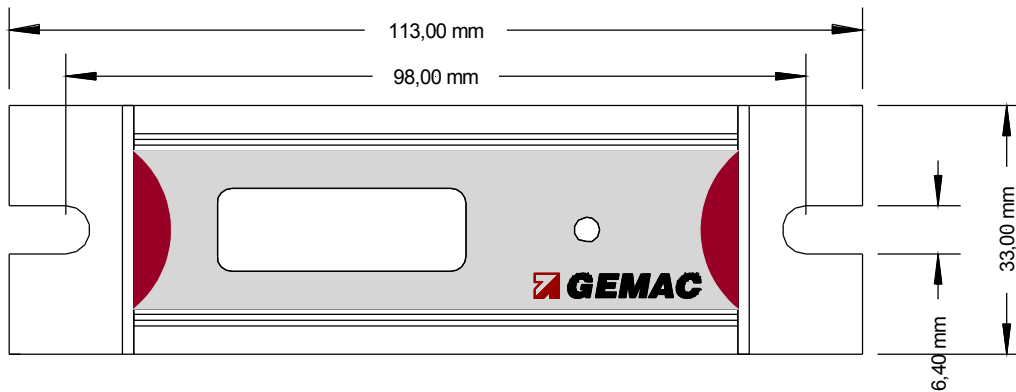
20.2 AZ μ – Display Unit for Magnetic Read Heads

Characteristics:

- Display unit for magnetic read heads of GC-MK-series
- 8-digit display
- Counter reset
- Power supply 24VDC or 230VAC via AC/DC adapter (included in scope of delivery)
- Maximum resolution in accordance to the sensors used 1 μ m, 2 μ m, 5 μ m



Dimensions:



Technical Data*:

General Parameters	
Power supply	24VDC or 230VAC (via AC/DC adapter)
Power consumption	120 mA
Construction	Aluminium housing with mounting brackets
Cable length between sensor and display unit	1m (standard), up to 10m on request
Display	8-digit
Temperature range	0 ... 70°C

A detailed description of the technical data is found in the according user manual under www.gemac-chemnitz.de.

Ordering Information:

Product Type	Description	Item No.
AZ μ 1	Display unit for magnetic read head GC-MK1	PR-45100-00
AZ μ 2	Display unit for magnetic read head GC-MK2	PR-45200-00
Az μ 5	Display unit for magnetic read head GC-MK5	PR-45300-00