

Kemro

MM 240/A

Encoder interface module

Project engineering manual V1.08

Translation of the original instructions

KEBA[®]

Automation by innovation.

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V1.04	07-2007	Technical data	New structuring of the project engineering manual, detailed power ratings	meis
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V1.06	06-2008	Front view, setting the address	Information on electronic type plate	meis
V1.07	03-2010	Overview of functions	Added Position Counter, Technical Data: Added Incremental Encoder	hasl, bru
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1 Introduction

1.1 Purpose of the document

This document describes the structure of the MM 240/A (Encoder interface module).

1.2 Target groups, pre-requirements

This document is intended for the following persons with adequate skill pre-requirements:

Target group	Knowledge and skills pre-requirement
Project engineer	<p>Basic technical training (University of Applied Science/University level, engineering degree or corresponding professional experience).</p> <p>Knowledge in:</p> <ul style="list-style-type: none"> • working mode of a PLC, • safety regulations, • the application.
Operator	<p>Basic technical training (Vocational high school, engineering degree or corresponding professional experience).</p> <p>Knowledge in:</p> <ul style="list-style-type: none"> • safety regulations, • working mode of machine or plant, • principal functions of the application, • system analysis and troubleshooting, • setting options at the operating installations.
Service technician	<p>Basic technical training (Vocational high school, engineering degree or corresponding professional experience).</p> <p>Knowledge in:</p> <ul style="list-style-type: none"> • working mode of a PLC, • safety regulations, • working mode of machine or plant, • diagnosis possibilities, • systematic error analysis and rectification.

1.3 Intended use

The MM 240/A was developed for control applications in industrial machines. The typical applications areas include injection molding machines, robots, presses, machine tools and similar.

The assembly must only be used for the above-mentioned applications and only in connection with recommended or approved third-party equipment.

The MM 240/A has been developed, manufactured, tested and documented in accordance with the appropriate safety standards. Therefore, the products do not pose any danger to the health of persons or a risk of damage to other property or equipment under normal circumstances, provided that the instructions and safety precautions relating to the intended use are properly observed.

1.4 Notes on this document

This manual is integral part of the product. It is to be retained over the entire life cycle of the product and should be forwarded to any subsequent owners or users of the product.

1.5 Documentation for further reading

The following documents are to be observed depending on the system solution used:

If you are using the KeStudio U2 tool suite:

Doc.No.	Name	Target group
DE: 65352 EN: 65353	K2-200 automation system manual	<ul style="list-style-type: none"> • Project engineer • Electrician • Programmer • Commissioning foreman • Service technician

If you are using the KeStudio U3 tool suite:

Doc.No.	Name	Target group
DE: 1000868 EN: 1000869	System manual Kemro automation system	<ul style="list-style-type: none"> • Project engineer • Electrician • Programmer • Commissioning foreman • Service technician

2 Safety notes

2.1 Representation

At various points in this manual you will see notes and precautionary warnings regarding possible hazards. The symbols used have the following meaning:



DANGER!

- indicates an imminently hazardous situation which will result in death or serious bodily injury if the corresponding precautions are not taken.
-



WARNING!

- indicates a potentially hazardous situation which can result in death or serious bodily injury if the corresponding precautions are not taken.
-



CAUTION!

- means that if the corresponding safety measures are not taken, a potentially hazardous situation can occur that may result in property injury or slight bodily injury.
-

CAUTION

- CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in damage to property.
-



- This symbol reminds you of the possible consequences of touching electrostatically sensitive components.
-

Information

Useful practical tips and information on the use of equipment are identified by the "Information" symbol. They do not contain any information that warns about potentially dangerous or harmful functions.

2.2 General safety instructions



WARNING!

- It is absolutely essential to observe the safety instructions in the system manual.
 - The module is defined as "open type equipment" (UL508) or as "offenes Betriebsmittel" (EN 61131-2) and must therefore be installed in a control cabinet.
-

CAUTION

Improper use of the assembly or the control system leads to irreparable damage!

- Turn off the power supply before inserting or removing the module. Otherwise, the module can be destroyed or undefined signal states can lead to damage of the control system.
-

3 Description of the module

The MM 240/A is an Encoder interface module with 2 incremental encoder inputs. It has two latch inputs for recording events.

3.1 Front view

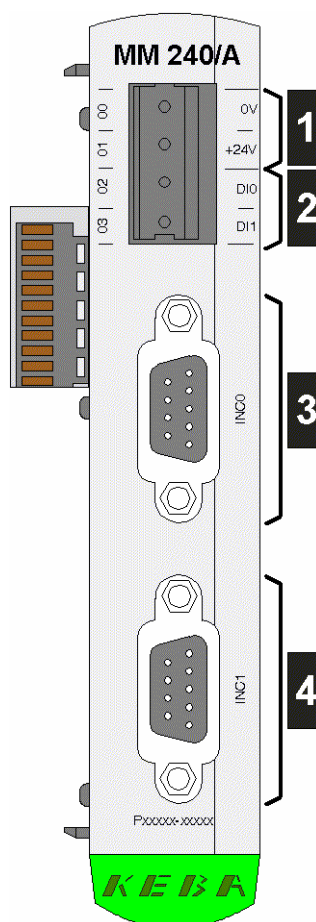


Fig.3-1: MM 240/A front view

1 ... power supply	2 ... 2 Latch inputs
3 ... Encoder input 0	4 ... Encoder input 1

Information

- *The Encoder interface module MM 240/A is not designed for drive control.*
- *The type plate is stored on the module in an EEPROM and can be read out by the application.*

3.2 Accessories

3.2.1 Connector strip

Input-/output signals: Standard male connectors with grid dimension 5.08 mm.

The following female connectors are required for the MM 240/A:

- 1 block with 2 connections (module supply)
- 1 block with 2 connections (latch inputs)

Female connector	Color	Number	Order no. Weidmüller
2-pole	sw	1	BLZF 5.08/2 SN SW - 170769

Information

Larger terminal blocks may be used to group multiple signals. The current carrying capacity of the terminal block is thus, however, reduced (according to derating curve of the terminal block manufacturer.)

The appropriate female connectors are not included in the delivery of KEBA, but can be purchased from KEBA.

For further information: See System manual.

4 Connections and wiring

4.1 Power supply



WARNING!

Danger of personal injury due to electric shock!

- Supply the device exclusively from power sources that have an extra low voltage (e.g. SELV or PELV according to EN 61131-2)
 - Connect only voltages and power circuits to connections, terminals and interfaces up to 50 V rated voltage that have a secure disconnect for hazardous voltages (e.g. with sufficient isolation).
-



CAUTION!

Fire hazard during module failure!

- Provide suitable fuses for the 24 V DC power supply for the final application. Only fuses with a maximum nominal disconnecting current of 10 A may be used.
-

4.1.1 Module supply

The module is supplied by the CPU via the K-Bus. The max. permitted fuse is 10A. (recommended fuse protection: circuit line breaker LSS 10A – type B).

4.1.2 Supply for connected transducers



CAUTION!

No galvanic isolation!

Voltage reversal leads to a short circuit between GND and 24 V.

The MM 240/A provides a 24 V and 5 V supply voltage for the connected incremental encoders.

Power supply is via the 24 V terminal at the front. The 24 V are looped through secured. In addition, 5 V are generated internally from the 24 V. The 5 V transducer supply can carry loads of up to 100 mA each.

4.2 Latch inputs

The latch inputs can be operated in 2 operating modes:

- as SINK input,
- as SOURCE input.

The configuration is carried out by software.

4.2.1 Connection example

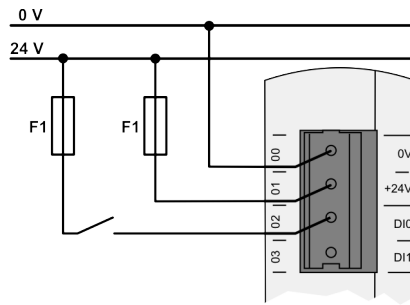


Fig.4-1: Connection example for SINK input

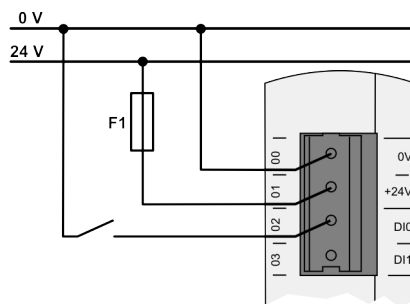


Fig.4-2: Connection example for SOURCE input

4.2.2 Connection diagram

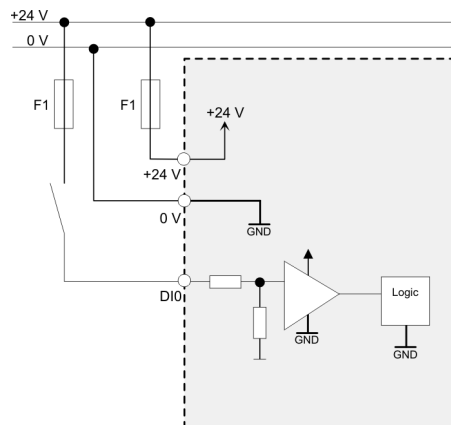


Fig.4-3: Connection diagram latch input (SINK configuration)

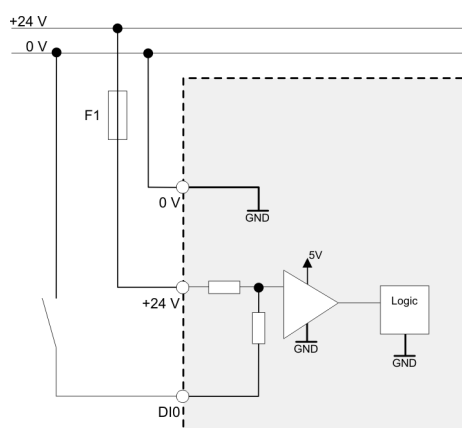


Fig.4-4: Connection diagram latch input (SOURCE configuration)

4.3 Encoder interface

The module is connected to the encoder via a 9-pole DSUB socket of the module.

The encoder inputs can be operated in 2 operating modes:

- 5 V differential,
- 24 V single ended.

The configuration is carried out by software.

Information

If only one encoder is used, it must be connected to the upper interface (INC0).

Mode: 5 V differential

The specifications from the system manual on the topic Interfaces RS-485/422 are to be observed.

Mode: 24 V single-ended

- Wiring can be unshielded.
- Lines of an encoder input not to be laid out in separately.
- The grounding conductors (collar of shield of DSUB socket or Pin 1 of DSUB socket) must be laid out together with other lines, routed to the respective encoder and used as reference voltage of the encoder signal there.

4.3.1 Connection example

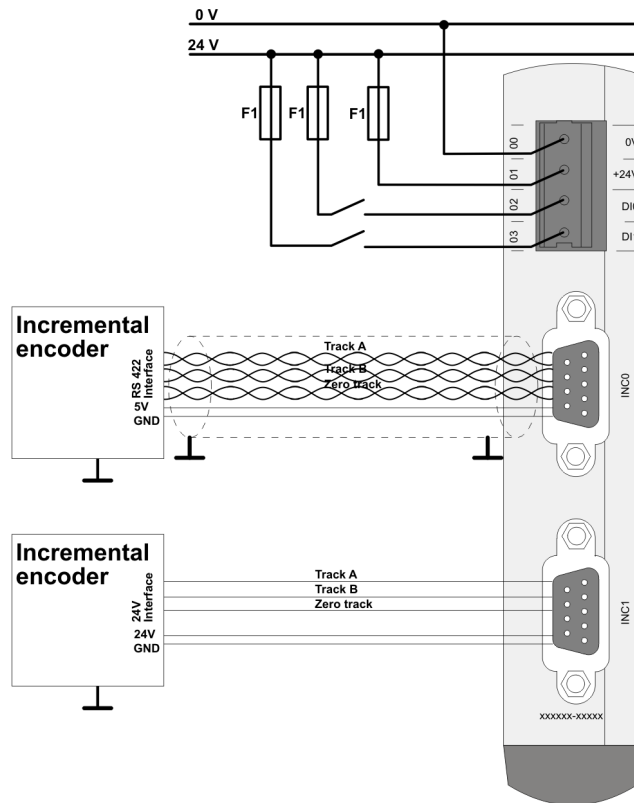


Fig.4-5: Connection example for encoder inputs with transducer supply and latch

- INC0 is connected to a transducer via a 5 V (differential) interface. The transducer is supplied with 5 V operating voltage by the MM 240/A.
- INC1 is connected to a transducer with 24 V interface. The transducer is also supplied by the MM 240/A.
- The latch function is used for both transducers. The latch inputs are configured to Sink.

4.3.2 Pin assignment

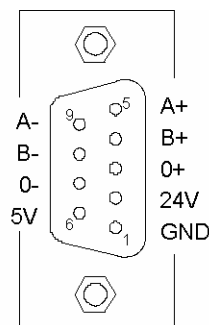


Fig.4-6: Encoder interface, 9-pole DSUB socket connection, seen from front

Signals

PIN no.	PIN designation	Signal designation 5 V diff.	Signal designation 24 V
5	A+	Track A+	Track A+
9	A-	Track A-	do not connect
4	B+	Track B+	Track B+
8	B-	Track B-	do not connect
3	0+	Zero track+	Zero track+
7	0-	Zero track-	do not connect

power supply

PIN no.	PIN designation	Signal designation 5 V diff.	Signal designation 24 V
2	24V	Transducer supply	Transducer supply
6	5V	Transducer supply	Transducer supply
1	GND	ground	ground

4.3.3 Connection diagram

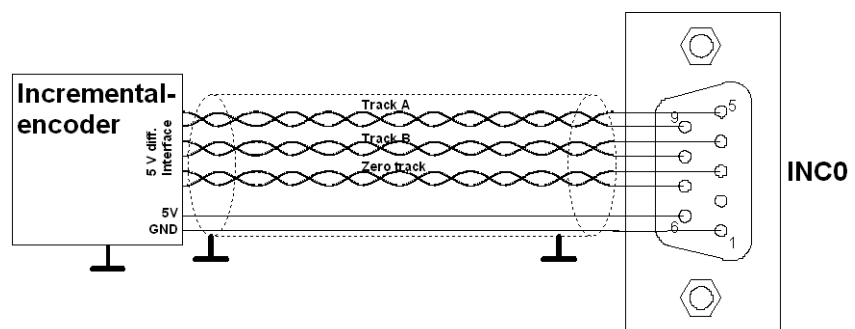


Fig.4-7: Connection diagram for incremental encoder with 5 V power supply, differential operation, signal voltage 5 V

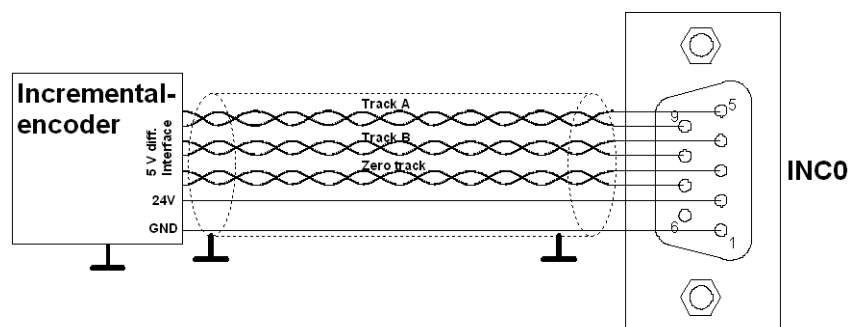


Fig.4-8: Connection diagram for incremental encoder with 24 V power supply, differential operation, signal voltage 5 V

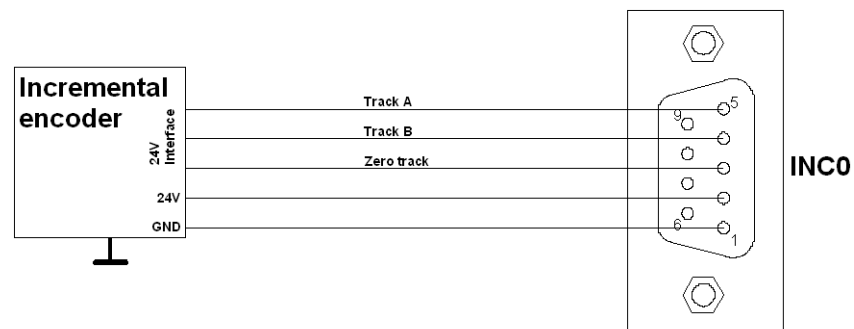


Fig.4-9: Connection diagram for incremental encoder with 24 V power supply, single-ended, signal voltage 24 V

4.3.4 Cable and plug specification

Further information: See system manual.

4.4 EMC and wiring guidelines

Pay attention from the outset to careful wiring and shielding.

Further information: See system manual.

5 Configuration

General information

A Kemro-system needs data for the configuration of system performance, its I/O-devices and interfaces. The system reads this data during the start-up operation and allocates them to its components and devices.

Configuration data is created by included configuration tools or by editing configuration files.

The tools included for the creation of configuration data are dependent on the specific system-combination.

For further information to the configuration see the documentation of the included configuration tool.

5.1 Setting the K-Bus address

The module is addressed via the address switch.

The number of modules that can be added on is limited as follows:

- 8 pieces MM 240/A to a CPU module (permitted address switch positions 0 - 7).
- 5 pieces MM 240/A to a bus link module BL 250/A (permitted address switch positions 0 - 4).
- 2 pieces MM 240/A to a bus link module BL 210/A (permitted address switch positions 0, 1).

The address switch is located on the right side underneath the lower cover (the K-Bus plug is located underneath the upper cover).

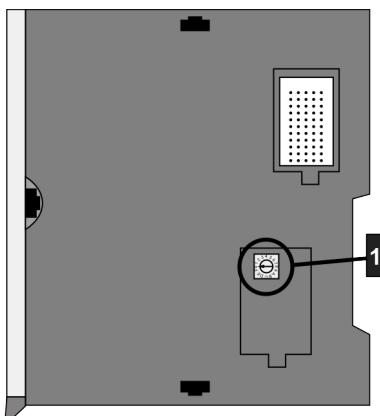


Fig.5-1: Position of the address switch

1 ... Address switch

On leaving the factory all modules are set to address 0 and both covers are closed.

Information

Modules of the same type that are installed within the same line must have different address switch positions. Different modules (e.g.: AI 240/A and DI 260/A) may have the same address switch positions.

The two covers for the K-Bus plug and the address switch must remain locked at the last module in the line (to protect against dirt and damage through electrostatic discharge on contact).

6 Functional description

6.1 Position measurement

Position measurements are taken from the evaluation of an incremental pulse position transducer with 2 pulse signals (A, B), which are phase-shifted by 90°. All edges can be evaluated. The possible resolution amounts 1/4 of the period's duration (4-fold evaluation). The type analysis can be chosen in the configuration.

Position measurement once

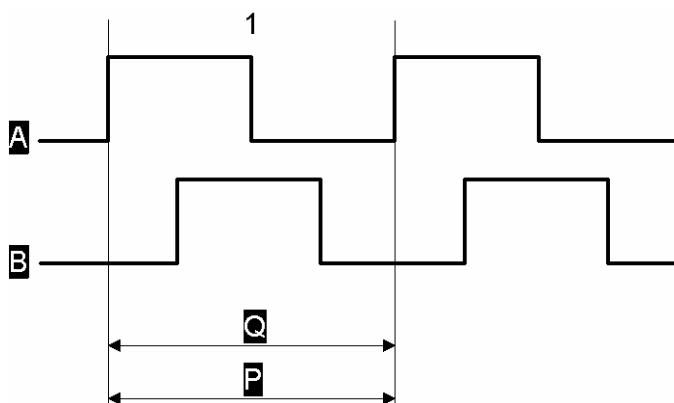


Fig.6-1: Impulse signals of the position transducer, resolution 1-fold

A, B ... Pulse signals of the position transducer	P ... Cycle Time
Q ... Resolution 1-fold	

Position measurement 2-fold

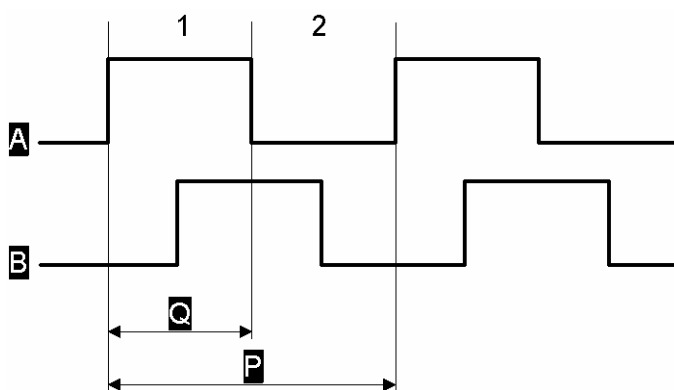


Fig.6-2: Impulse signals of the position transducer, resolution 2-fold

A, B ... Pulse signals of the position transducer	P ... Cycle Time
Q ... Resolution twice	

Position measurement 4-fold

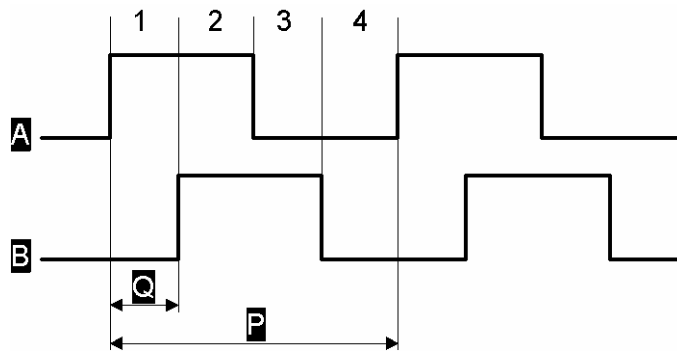


Fig.6-3: Impulse signals of the position transducer, resolution 4-fold

A, B ... Pulse signals of the position transducer	P ... Cycle Time
Q ... Resolution 4-fold	

The direction of the movement is detected by the evaluation of the phase position of the pulse signals A and B. See following figure:

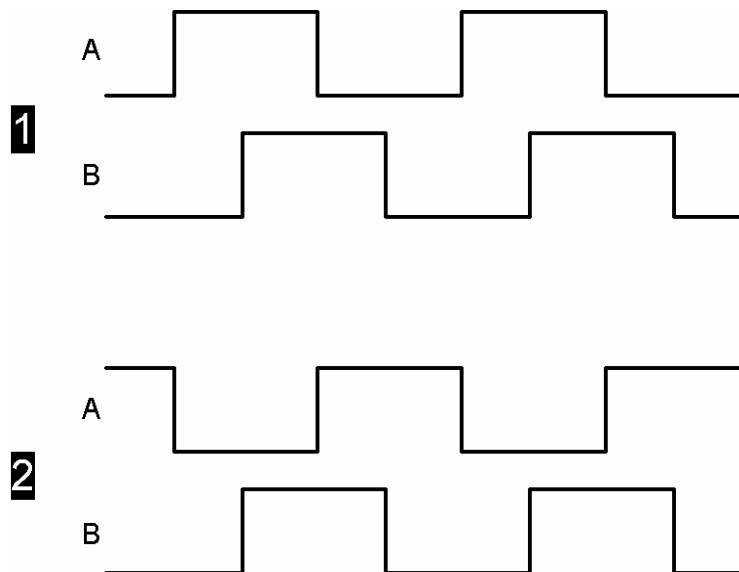


Fig.6-4: Pulse signals of the position transducer, identification of the movement direction

1 ... forward
2 ... backward

6.2 Position counter

The position counter is a relative counter, that starts at Zero and is updated permanently.

6.3 Speed measurement

The velocity measurement function can be used to obtain a good accuracy of the evaluation when using a rotary encoder with a low resolution. This is done by measuring the period duration between two incremental encoder pulses by means of an internal time basis. The velocity measurement can be made in either direction.

The velocity value is measured four times for each period duration. If the direction is changed during an ongoing measurement, the measurement is started anew. Once the measurement is completed the value is marked as new. The input pulses are scanned with an internal timing of 50 MHz. At a maximum input frequency of 250 kHz this will result in a resolution of at least 8 Bit. Frequencies that are smaller than 3 pulses per second are evaluated as zero velocity.

6.4 Pulse counter without direction evaluation

This function makes the pulse counter at track A available (edgeCount=4). No direction information is taken into account. Track B and Track Zero are not evaluated.

6.5 Pulse counter with direction evaluation

This function makes the pulse counter at track A available (edgeCount=5). The status of track B decides on the direction of counting.

Track B = 0: -> forward, Track B = 1: -> backward.

Track Zero is not evaluated.

6.6 Zero pulse monitoring

When a rotary encoder with Zero pulse is used, the configuration of the number of pulses per rotation (incrementsPerRev) will activate the monitoring, which compares the number of counted pulses with the number of configured pulses. If the numbers of pulses differs, an error message will be triggered.

This allows monitoring the correct function of the connected transducer.

6.7 Latch function digital input

A latch function is available (latchEdge) to record the counter status when an edge occurs at one of the latch inputs (DI0, DI1) of the MM 240/A.

The current counter status is recorded at the first edge. When the counter status is read out at the next update cycle the trigger will be activated again. If

another latch event (edge change) occurs before the next update, the information of the first event will be retained.

A time stamp on each latch event is recorded within the update cycle. The time stamp has a resolution of 1 μ s. This time stamp is unique up to an update cycle of 65 ms. The possibility of an overflow exists for longer cycle times of the application program. Update cycles of the incremental encoder inputs of >65ms should thus be avoided

The latch inputs are firmly assigned to the incremental encoder inputs: INC0 - DI0, INC1 - DI1.

Information

To avoid faulty triggering of the latch inputs, attention should be given that the wiring is done correctly.

6.8 Latch function Zero pulse

Another latch function is available (zeroLatchMode=1) to record the counter status when a Zero pulse occurs at an incremental encoder.

The current counter status is recorded when the Zero pulse occurs. When the counter status is read out at the next update cycle the trigger will be activated again.

6.9 Simulation mode

During simulation mode (simulate=1), the transducer signals are simulated by internal software test signals and evaluated instead of the transducer signals. The simulation mode can be selected through the configuration. The application has to provide the actual values, which are then read out via the standard interface.

This way application tests can be conducted without the incremental encoder being connected.

7 Operating behavior

7.1 Response to sensor failure

This monitor checks the signal level of transducers with 5 V diff. interface. Both, the open signal lines as well as the short-circuited transducer lines are identified.

7.2 Behavior at transducer error

If the Zero pulse monitor is activated through configuration of the number of increments per rotation, the MM 240/A will internally monitor the number of pulses between two Zero pulses. If the number deviates, an error will be triggered.

7.3 Behavior at short circuit of transducer supply

Both outputs for the transducer supply are sustained short-circuit proof and protected against overload.

7.4 Monitoring track errors

If the maximum input frequency is exceeded, or if the edges of the incremental encoders are too close to one another (e.g. if there is no 90° phase difference between the tracks), this will be identified as error and signaled as such.

8 Disposal

8.1 Disposal of the module

CAUTION

Please observe the regulations regarding disposal of electric appliances and electronic devices!



- The symbol with the crossed-out waste container means that electrical and electronic devices including their accessories must not be disposed of in the household garbage.
- The materials are recyclable in accordance with their labeling. You can make an important contribution to protecting our environment by reusing, renewing and recycling materials and old appliances.

9 Technical data

9.1 In general

Power supply voltage:	24 V DC from the front connection (19.2 V to 30 V, acc. to EN 61131-2) 24 V DC from K Bus, 5 V DC from K Bus.
Overvoltage category:	II
Equipment class:	III according to EN 61131-2:2007
Addressing at K-Bus:	Via 16-digit address switch, on the side
Connection terminals:	Open terminals, grid dimension: 5.08 mm
Max number of add-on modules:	to CPU modules: 8, to a LABL 210/x: 2
Max. power consumption K Bus 24 V:	0 W
Max. power consumption K Bus 5 V:	0.6 W

9.2 Incremental encoder inputs

Number of inputs:	2
Entrance area:	Configurable 5V differential and 24V
Max. input frequency:	250kHz (differential) configurable 1-fold, 2-fold, 4-fold
Interpretation:	Counter function with and without interpretation of direction
Max. impulse rate:	1 MHz when using 4-fold interpretation (differential)
resolution:	32 bit
Galvanically isolated:	No

9.3 Environmental conditions

Operating temperature:	+5 °C to +55 °C
Storage temperature:	-40 °C to 70 °C
Relative humidity of air:	10 % to 95 % (non condensing)
Vibration resistance:	according to EN 61131-2:2007
Shock resistance:	according to EN 61131-2:2007

9.4 Speed measurement

Measurement process:	Dead time measurement with internal 50 MHz cycle
Counter depth:	24 Bit
Minimum recordable velocity:	Pulse duration over 0.33s = velocity 0.

9.5 Position counter

Counter depth:	32 Bit.
----------------	---------

9.6 Transducer supply

Supply 24 V:	Looped through from 24 V input terminal
Load capacity:	100 mA per transducer
Secured against:	Overload and short circuit
Supply 5 V:	Generated from 24 V supply via input terminal
Rated voltage:	5.05 V +/-4 %

9.7 Latch inputs

Number of inputs:	2
Response time latch input:	20 µs
Input type:	Configuration as sink or source input
Galvanic isolation:	No

9.8 Time stamp for latch event

Resolution:	1 µs
Max. cycle time:	16 Bit counter: Unique up to 65 ms cycle time.

9.9 Interfaces

K-Bus:	Parallel Bus-interfaces, plug-in on side.
--------	---

9.10 Diagnosis possibilities

Sensor failure and sensor short circuit at input configuration: 5 V differential. Zero pulse monitoring
--

Counter overflow

Track error: Signal frequency at inputs outside specifications (max. 250 kHz).

9.11 Dimensions

Footprint:

- Module height: 120 mm
- Mounting depth: 100 mm
- Front panel width: 22.5 mm
- Module width (incl. K-Bus plug): 32.5 mm

Weight: 135 g.

10 EC directives and standards

10.1 EC directives

Guideline 2004/108/EG	EU guideline on electromagnetic compatibility
Guideline 2002/95/EG	RoHS guideline

10.2 Standards

To check the conformity of the system with the directives, the following non-binding legal European standards were applied:

10.2.1 General procedures and safety principles

EN 61131-1:2003	Programmable controllers - Part 1
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Information

This product was developed for the use in industrial areas and can cause radio interference when used in residential areas.

10.2.2 EMC guideline

EN 61131-2:2003	Programmable controllers - Part 2
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10.2.3 Electrical safety and fire protection

EN 61131-2:2003	Programmable controllers - Part 2
-----------------	-----------------------------------

10.2.4 Environmental and surrounding conditions

EN 61131-2:2003	Programmable controllers - Part 2
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10.3 Standards for the American market

10.3.1 UL test for industrial control equipment

UL 508, 2005	Industrial Control Equipment
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11 Declaration of conformity



EC Declaration of Conformity



KEBA AG
Gewerbepark Urfahr
4041 Linz
AUSTRIA

Document No.: 65505/CE/2

We declare that the following product(s)

Name of product: MM 2x0
 Variants: MM 240/A, MM 280/A
 From: revision 04 (Mat.Nr. 73983)
 revision 02 (Mat.Nr. 76796)
 revision 05 (Mat.Nr. 71784)
 revision 09 (Mat.Nr. 65505)
 revision 05 (Mat.Nr. 71476)

is/are in conformity with the essential requirements of the following European Council Directive(s):

∞ EC-Directive relating to electromagnetic compatibility 2004/108/EC

Conformity to the directive 2004/108/EC is assured by the compliance with the applicable parts of the following harmonized european standards:

∞ EN 61131-2:2007

Important notes:

Any modification on the product(s), that is performed without KEBA's consent will render this declaration invalid.

This declaration certifies the conformity with the directives mentioned, but does not imply any warranty of the features of the product(s).

The safety instructions contained in the documentation supplied with the product(s) must be followed.

kemro_k2_mm280-engl2