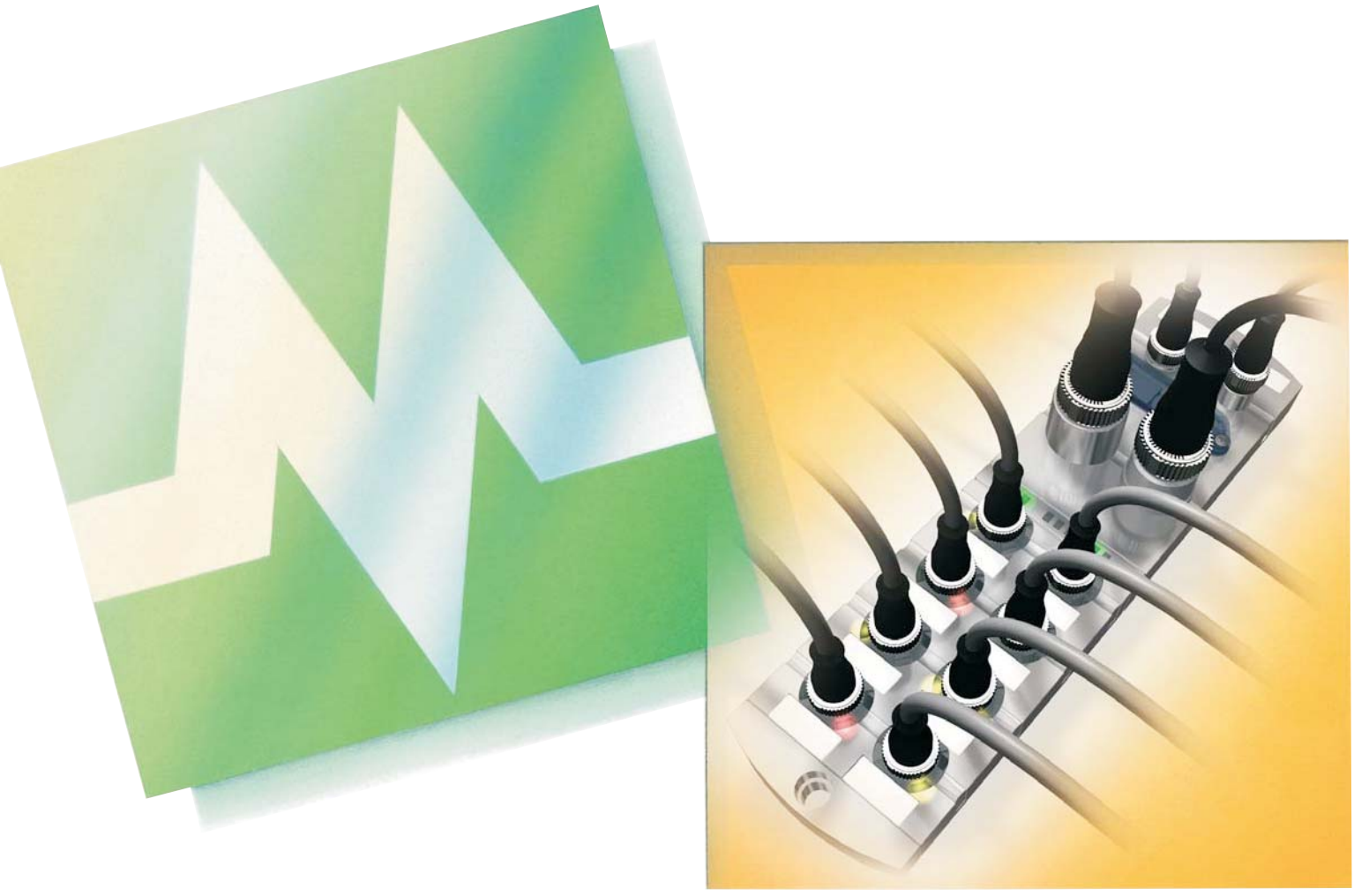
MURR ELEKTRONIK

Handbuch
Manual
Manuel

MVK-MI

Art.-No. 55294
Art.-No. 55295
Art.-No. 55296



MVK-MI Series
User's Manual

Art.No. 55 294 DI8 (DI8)
Art.No. 55 295 DIO8 (DI8)
Art.No. 55 296 DIO8(DIO8)

User's Manual Art.-No. 55 387 Version 1.0

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Manual supplements / Corrections

Version	Chapter	Supplements / Corrections	Date/ Name
V 1.0		Created	11.04.05 M.H./ HE

Notes:

1 Concerning this manual

Please take the time to read this User's Manual **prior** to setting up and operating MVK-MI components. The User's Manual must be kept in a conspicuous place and accessible to all authorized personnel.

The text, illustrations, diagrams and examples used in this manual serve solely for the purpose of explanation, operation and application of Input/Output modules of the MVK-MI series.

If you should have any further reaching questions regarding the installation and set-up of the equipment described in this manual, please don't hesitate to contact us. We would be glad to assist you any time.

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Murrelektronik reserves the right to make technical changes or modifications to this manual without prior notice.

1.1 Chapter overview

The "Safety information" section must be read without fail **prior** to working with the products and the system. This section contains information required for safe installation and handling.

The "Configuration Information" section directs itself to system planners. It offers important information and details relevant to successful configuration.

The "Installation" section provides details regarding installation, in both mechanical and electrical contexts. This chapter addresses itself in particular to qualified and trained electricians responsible for the assembly and installation of system components.

The "Setup" and "Diagnosis" sections are intended for the setup personnel. They offer important notes and information with regard to the rapid and uncomplicated setup in a Profibus DP network.

2 Safety information

2.1 Explanation of symbols

2.1.1 Use of attention signs

Notes containing important information are specially marked. These are illustrated as follows:

Attention text.....

2.1.2 Use of danger signs

Danger signs are additionally marked with an enclosing frame.

Caution:
Disregard of safety measures may result in damage to equipment and other serious consequences.

DANGER:
Non-compliance with the relevant safety measures poses a danger to the health and life of the user.

2.1.3 Use of numbering in illustrations

Illustrations are numbered with white numbers in black, round fields.
Example:
❶ Text 1.....
❷ Text 2.....
❸ Text 3.....

The explanatory text follows in tabular form under the same number, in direct context to the preceding illustration.

2.1.4 Use of handling information

Handling information describes the sequence of steps during installation, setup, operation and maintenance that must be strictly observed.

The numbering (black numerals in a white field) is given in a sequential and ascending order.
Example:
① Instruction 1.....
② Instruction 2.....
③ Instruction 3.....

2.1.5 Use of foot notes

Supplementary information is marked with superscripted numerals (example: Text Text [1)] Text Text). These are explained in the form of footnotes beneath tables or text at the end of the page.

2.2 Designated use

The devices described in this manual serve as decentralized input/output modules intended for connection to a Intebus network.

The products described in this manual

- have been developed, manufactured, tested and documented in compliance with currently valid safety codes. The equipment poses no danger to operating personnel or material if configuration, assembly, and operation are performed in compliance with the stated handling and safety regulations.
- fulfill the requirements of:
  - EMC directives (89/336/EWG, 93/68/EWG and 93/44/EWG)
  - low voltage directive (73/23/EWG)
- and are designed for use in an industrial environment. An industrial environment is one where the consumers are not directly connected to the public low voltage supply network. Additional measures must be taken for use in residential areas or in office and business environments.

Warning!
This is class A rated equipment. Operation of this equipment in a residential environment can cause radio interference, in which case the user can be required to take necessary corrective measures.

Fault-free and safe function of this equipment is guaranteed only if the conditions for proper transport, storage, installation and assembly are observed.

The designated operation of the device is guaranteed only with the housing fully installed

Good chemical and oil resistance.
When using aggressive mediums, material resistance based on application must be checked.

All devices connected to this equipment must fulfill EN 61558-2-4 and EN 61558-2-6 requirements.

Only qualified and suitably trained electrical tradesmen knowledgeable in the safety standards of automation technology may perform configuration, installation, setup, maintenance and testing of the equipment.

Current safety and accident prevention laws valid for a specific application must be observed in the configuration, installation, setup, maintenance and testing of the equipment.

Only cables and accessories are allowed that meet the requirements and regulations for safety, electromagnetic compatibility and, where applicable, telecommunications transmission equipment and specifications.
Information concerning the type of authorized cables and accessories can be obtained from your Murrelektronik distributor or are described in this manual.

2.3 Qualified personnel

Requirements to be met by qualified personnel are based on qualifications profiles described in ZVEI and VDMA guidelines.

Weiterbildung in der Automatisierungstechnik (Further training in automation technology)
Herausgeber: ZVEI and VDMA (Publisher: ZVEI and VDMA)
Maschinenbau Verlag
P.O. Box 71 08 64
60498 Frankfurt

Only trained electricians familiar with the contents of this manual may be allowed to install and service the components described here.

These are understood as being persons who,

- based on their trade qualification, experience and knowledge of relevant standards, are able to assess the project requirements and to recognize possible hazards.
- based on extensive experience in comparable areas, possess the same level of knowledge as could be expected of a trained tradesman.

Only Murrelektronik technical personnel are allowed to undertake intervention in the hardware and software of our products, unless the procedure is described in this manual.

Warning!
Unqualified intervention in the hardware and software of our equipment or the disregard of warnings and information provided in this manual can result in injury or serious damage to man and/or material.

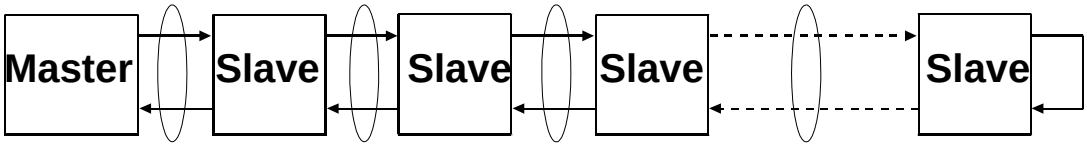
3 Configuration information

3.1 System description

The Interbus is a high-speed, universal sensor/actuator bus system n the form of a data ring.

A serial bus cable connects the master to input/output modules installed in the system. The necessary wiring can therefore be reduced to a minimum in comparison to conventional parallel wiring.

Each slave constitutes part of a shift register which, when combined, forms a large shift register. Data transfer takes place in a master-slave-access process.
The ring structure offers the possibility of simultaneous transmission and reception of data (full duplex). The bus cable between individual participating modules always contains conductors for forward and for return transmission of data signals.



♦ *Fig. 3-1 Bus topology/Data ring*

The application area concentrates mainly on lower level industrial automation for networking of analog and binary sensors and actuators.
The Interbus is a substitute for traditional wiring between sensors, actuators and the PLC.
System-based mechanisms and software tools effectively support setup, operation, maintenance and diagnosis.

Every Interbus system requires a control unit, the master. This is available as a PLC specific module or in the form of a PC card.
The application program on the control system or PC controls the process via the master and the de-centralized I/O groups, the slaves.
The master performs cyclical information exchange between the master and the slaves independently.
An identification cycle is started immediately after switch-ON. During this system initialization phase, the master reads the identification data of all slaves in the sequence of their physical location.
This data serves (among other things) to prepare a periphery map in the master.
Subsequent cycles are purely data cycles and serve solely to exchange process data between the master and the slaves.
According to standard specifications, an Interbus network supports the operation of maximum 256 slaves and can reach a max. extension of 13 Km with copper cables and >80 Km using fiber optic cables.
The distance between individual remote bus modules must not exceed 400 m (using copper conductors).

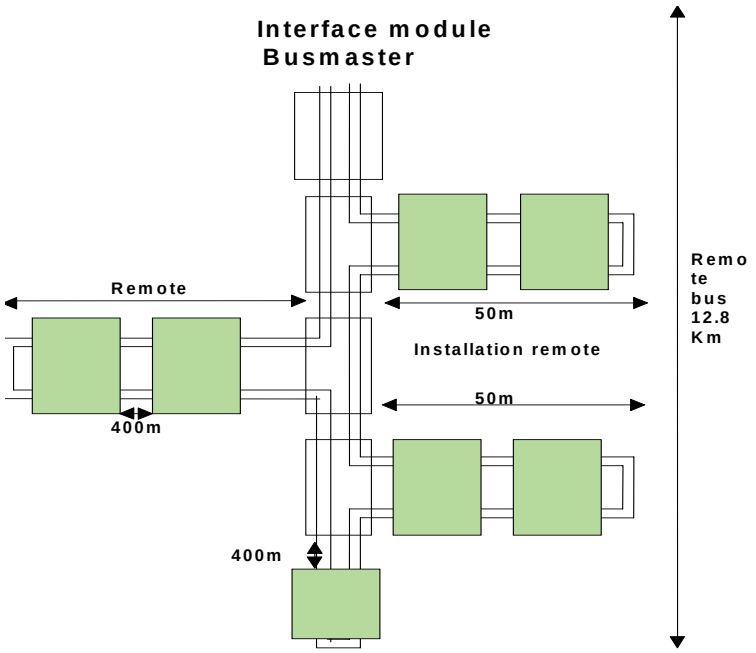
The following transmission distances between two modules are possible when using fiber optic cable technology:

Polymer fiber	max. 50 m
HCS fiber	max. 300 m
Glass fiber	max. 2500 m

Besides the remote bus, there is also a remote Installation bus.
The remote Installation bus differs from the remote bus as follows:

The power supply (24 V DC) is carried by the system cable. The max current is limited to 4.5A according to specifications. The sum of all cable segments is maximum is 50m.

MVK-MI modules are suitable for operation in the remote bus.



♦ *Fig. 3-2: Interbus system topology*

The cycle time depends on the degree of expansion. With full system expansion, 4096 I/O points, the cycle time is: 7.2ms.

3.2 System data

Topology	Active ring – Tree structure with max. 16 levels
Transmission media	- Copper cable (RS-485; Transmission distance 400 m) - Fiber optic cable (Polymer 50 m, HCS 300 m, glass fiber 2500 m)
Cable length of remote bus	Sum of all cable segments max. 12.8km
Cable length of remote Installation bus	Sum of all cable segments max. 50 m
Number of remote bus modules	Max. 256 (limited by master firmware)
Number of Interbus modules	Max. 512 (limit due to handling)
Number of I/O points	Max. 4096
Number of data words	Max. 256
Baud rate	500 kBaud
Messages	Cyclic messages from the master to individual slaves (Master call) with instant reply from slave (slave reply)
Data cycle time per slave (without master run time) DI16/DO16	0.105 ms
Error recognition	Identification of faulty messages, automatic repeat
Master functions	- System initialization - Automatic slave detection - Non-cyclical parameter transmission - Bus and slave diagnosis - Error messages to control

Table 3-1: *Interbus system data*

3.3 *Information for the beginner*

The Interbus is a field bus system for industrial application whose advantages include not only ease of handling in planning and application, but also a good general overview of the total system.

To make the system even easier and safer for beginners to use, we recommend proceeding as outlined in the checklist below:

Work phase	Questions	Note
Planning	How many I/O's are required in total?	This determines which types and how many Interbus modules are required.
Planning	How great is the system power requirement?	Important for the selection of suitable system power supply units and conductor cross sections.
Planning	How large is the total scope of the system?	The sum of all cable lengths may not exceed 12.8 Km if using copper cables.
Configuration	How are the modules to be assigned?	To avoid assignment errors, create an assignment scheme and carefully label all modules accordingly.
Installation	Where will the modules be installed?	Depends on the module enclosure type rating. Either in a switch cabinet or terminal box. Place modules of enclosure type IP 67 close to sensors and actuators for the sake of greater efficiency.
Setup	How will the system configuration be executed?	Automatic system configuration. The **C** (Configuration), **M** (Monitoring), **D** (Diagnostic) software is recommended for the setup.
Setup	Have all slaves been detected by the master?	When all slaves have been detected, data transfer is active and the "BA" and "RC" LED's on the slaves will light up green. The "RD" LED is OFF.
Setup	How can a simple I/O function test be performed?	Quick and straightforward, with special, easy to use configuration software (CMD). Alternatively via PLC software.

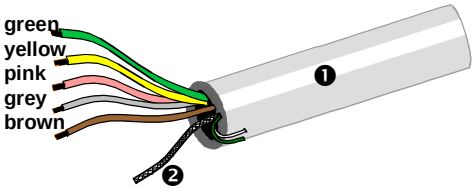
3.4 Electrical specifications

3.4.1 System cables

On the field bus side, system cables can be either of the remote bus or remote installation bus type, depending on different application requirements.

3.4.1.1 INTERBUS remote bus cable

The Interbus remote bus cable contains 3 stranded conductor pairs with a common screen.



❶ - Remote bus cable
❷ - Screen

♦ *Fig. 3-3: Remote bus cable*

3.4.1.2 System cable specifications

Characteristic value (20°C)	Value	Test method
Conductor cross-section	Min. 0.2 mm²	
DC conductor resistance per 100m	Max. 9.6 Ω	VDE 0472-501 IEC 189-1 cl. 5-1
Characteristic impedance	120 Ω ± 20 % at f = 0.064 MHz 100 Ω ± 15 Ω at f > 1 MHz	IEC 1156-1 cl. 3.3.3
Dielectric strength - Conductor / conductor - Conductor / screen	 1000 V_{eff} , 1 min. 1000 V_{eff} , 1 min.	VDE 0472-509 test type C or IEC 189-1 cl. 5.2
Insulation resistance (following dielectric strength test)	Min. 150 MΩ for 1 km cable	VDE 0472-502 test type B or IEC 189-1 cl.5.3
Max. Transfer impedance (transfer impedance) at 30 MHz)	250 mΩ/m	IEC 96-1
Operation capacity at 800 Hz	Max. 60 nF for 1 km cable	VDE 0472-504 Test type A or IEC 189-1 cl. 5.4
Min. close-up cross-talk impedance (NEXT) for 100 m cable - at 0.772 MHz - at 1 MHz - at 2 MHz - at 4 MHz - at 8 MHz - at 10 MHz - at 16 MHz - at 20 MHz	 61 dB 59 dB 55 dB 50 dB 46 dB 44 dB 41 dB 40 dB	VDE 0472-517 or IEC 1156-1 cl. 3.3.4
Max. wave attenuation for 100 m cable - at 0.256 MHz - at 0.772 MHz - at 1 MHz - at 4 MHz - at 10 MHz - at 16 MHz - at 20 MHz	 1.5 dB 2.4 dB 2.7 dB 5.2 dB 8.4 dB 11.2 dB 11.9 dB	VDE 0472-515 or IEC 1156-1 cl. 3.3.2

The following mechanical requirements apply to limited flexible cable routing (occasionally moved) and permanent routing in a dry, moist environment:

Variable	Value
Temperature range	-20 °C to +70 °C
Color coding of data cables	According to DIN 47100
Color coding of power supply cables	Red, blue, yellow/green
Jacket color	Green RAL 6017
Maximum outer diameter	8 mm
Minimum jacket inner diameter	5 mm
Minimal bending radius	80 mm
Connection method	Suitable for round plug connector IP65 9-pin (Coninvers)

3.4.2 Power supply

Interbus modules require a power supply of typically 24V DC, which must meet normal industrial power supply requirements.

We recommend the use of separate power supply sources for sensor & bus power and for the actuator power, in order to assure a higher degree of noise immunity and insulation. Primary switched-mode or unregulated power supplies should be used for voltage supply

The rating of the power supply units depends on the number of connected modules and on their power rating.

ATTENTION:
Always ensure that the system power, measured at the device furthest away from the system power supply, does not drop below 18V DC.
System behavior is undefined if the sensor & bus power supply drops below 18V.

Primary switched-mode power supply units, as a rule, allow the output voltage to be raised above the rated voltage in order to compensate for loss in the lines.

Interbus modules with digital inputs allow the direct connection of commercially available sensors.
A separate power supply for the sensors may be necessary, depending on the total power requirements of the overall system based on the number of slaves or when using sensors with high current consumption.

3.4.3 Recommended power supply units MCS*Power+*

Primary switched-mode power supply devices of the MCS*Power+* series are especially well suited for power supply to automation systems. We therefore recommend their use in supplying the MVK-MI.

Phases	Power output	Power input 95...132 VAC	Power input 185...265 VAC
1	240 W / 10 A	85086	85085
1	480 W / 20 A	85088	85087

Phases	Power output	Power input 3 x 340...460 VAC
3	240 W / 10 A	85095
3	480 W / 20 A	85097
3	960 W / 40 A	85099

3.4.4 Conductor cross-sections

The core cross-section is limited to max. 1.5 mm² and is restricted to this size by the 7/8" connector.

3.5 Slave profile

3.5.1 Identification code

The Interbus master marks each slave with an identification code to assure unequivocal, functional identification. This code is permanently programmed by the manufacturer and cannot be changed. The conditions for this are listed in the Interbus specifications.
The identification code consists of one data word (16 Bit).

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Management bits				Data width of module					Device group ID-Code or Ident. code							

♦ *Fig. 3-4: Bit assignment of identification code*

Management bits 13-15 transfer dynamic error messages to the master if a fault occurs.

Bits 8-12 define the data width of the slave.
Data widths from 4 Bits to 32 words are possible.

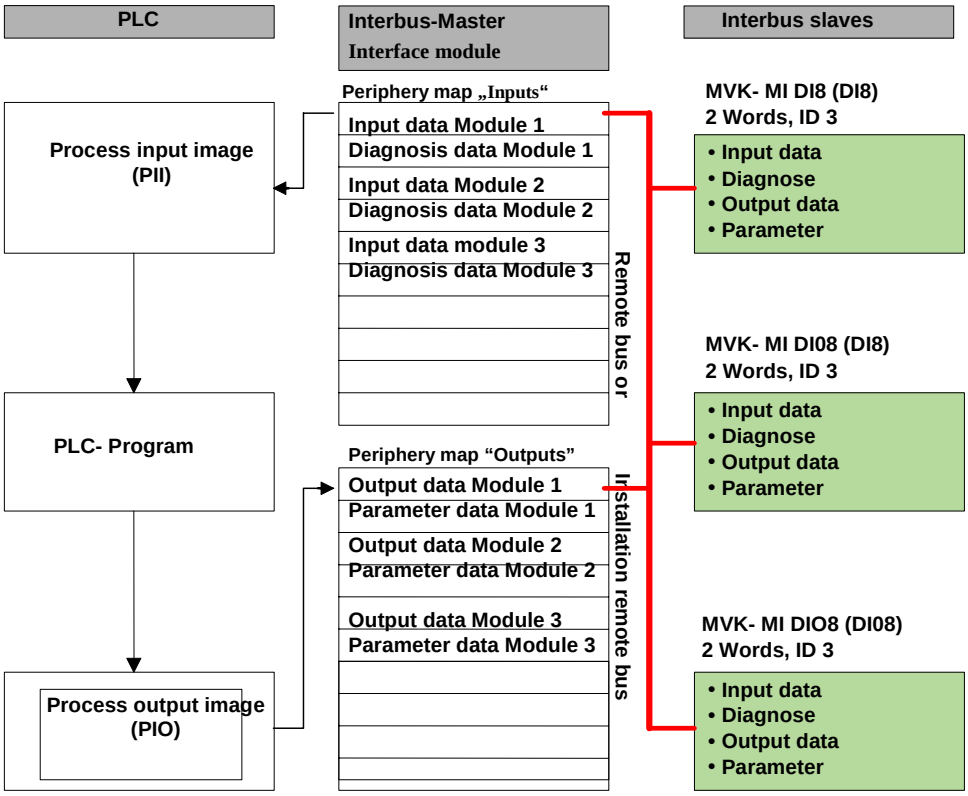
Example:
A slave with 16 input bits and 8 output bits occupies 1 word in the input area and 1 word in the output area. The larger value is always decisive in establishing the module-specific data width.

With the aid of bits 0-7, the master can identify the slave function and assign the I/O data to the various areas of the process map.
Bits 0-7 are also referred to as ID codes.

Modules of the MVK-MI series have the ID code 3 and a data width of 2 words

3.6 System configuration

The master has identified all its slaves during the initialization phase and has received information as to their data widths.
Based on this information, the master creates a periphery map of all detected slaves in the data ring.



♦ *Fig.3.6- : Data transfer between PLC, interface module (Master) and Interbus slaves*

The Interbus master creates a periphery map of all detected Interbus slaves and addresses them according to their physical location in the field bus.
The user has the option of assigning the physical periphery map of the Interbus slaves to logical addresses in the PLC.

3.6.1 Physical addressing

The assignment of the periphery map in the master to the process map of the PLC reflects the physical arrangement of the modules in the field bus.

Advantage:
No configuration expenditure, the assignment is automatic

Disadvantage:
Hardware changes in the periphery cause structural changes in the periphery map and thereby also to the process map in the control.

3.6.2 Logical addressing

Logical addressing can be performed manually during the configuration phase (depending on the master module employed), by using a suitable configuration software (e.g. CMD). The periphery map or parts of the periphery map is thereby logically assigned to the process map of the control.

Advantage:

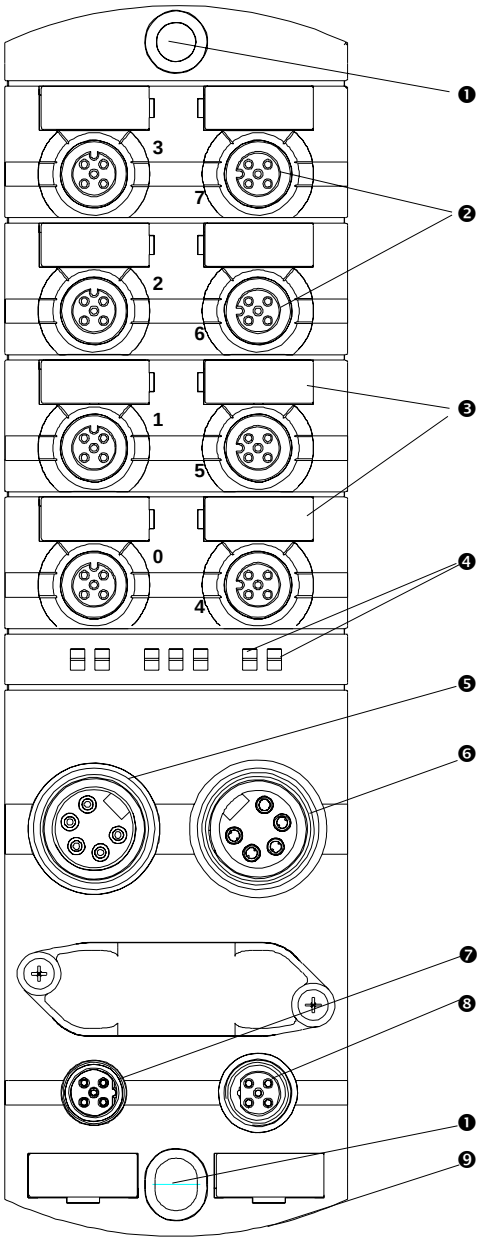
Hardware changes in the periphery produce no structural changes in the control process map. No configuration expenditure, as assignment is automatic.

Disadvantage:

Increased configuration expenditure.

4 Installation information

4.1 Connection overview



♦ *Fig 4-1: MVK-MI module connection layout*

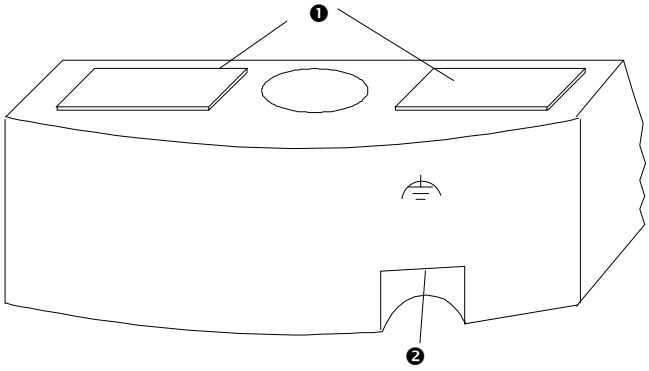
❶ Mounting hole
❷ M12 round connectors for inputs and outputs
❸ Identification label
❹ Display elements
❺ Power supply connection
❻ Outgoing power supply connection
❼ Incoming bus interface
❽ Outgoing bus interface
❾ FE connection

4.2 Connection to MVK-MI

① Connect the grounding cable to the FE terminal
② Connect incoming Profibus cables to the incoming bus terminal ❼.
③ Connect any outgoing Profibus cables to the outgoing bus terminal ❽
④ or attach terminating resistor to the outgoing bus terminal ❽.

4.2.1 Grounding cable

The FE connection is located at the bottom/side of the module housing.



♦ *Fig. 4-2: FE connection*

❶ ID. labels
❷ FE connection

Connect the grounding cable at the FE connection on the housing in a low impedance manner.

4.2.2 Interbus connection

4.2.2.1 Cables

Interbus field bus cable connection requires cables conforming to Interbus specifications.

We recommend using our prepared Interbus cables for easy and reliable wiring of the equipment.

The Interbus cables can also be prepared by yourself. We offer the following accessories:

Art . No.	Description	Comments
55 771	Interbus bus cable (by the meter)	remote bus
50 27606	M12 male connector B-coded, straight (screened)	
50 27601	M12 female connector, B-coded, straight (screened)	

Art. No.	Description
55 356	Terminating resistor plug

Any sockets that are not in use must be fitted with blind caps as IP 67 protection is otherwise not guaranteed.

Art. No.	Description
55 468	M12 blind caps, black (4)
33 8155	Diagnosis blind plugs M12
55 390	Blind cap 7/8" (external thread)

4.2.3 Pin assignment: M12 (B-coded) bus connector

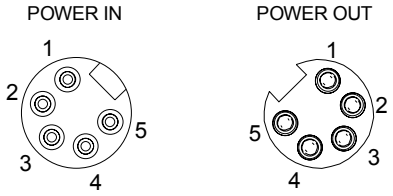
BUS IN BUS OUT

- *Fig. 4-3: Bus connector pin assignment*

pin No.	Signal	Significance	Colour
1	DO	Data line of IBS master	yellow
2	/DO	Data line of IBS master inverts	green
3	DI	Data line of IBS master	grey
4	/DI	Data line of IBS master inverts	pink
5	GND	Ground	brown
Threaded	Screen	Screen or FE	

The screen should be evenly distributed around the thread.

4.2.4 Pin assignment: 7/8" power connector (Mini-Style)

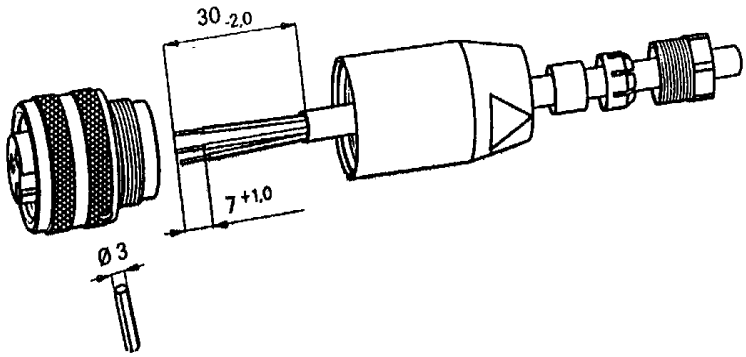


♦ *Fig. 4-4: Pin assignment:*

pin 1	0 V
Pin 2	0V
pin 3	PE
Pin 4	Sensor & bus power supply
pin 5	Actuator power supply

4.2.5 Power supply connection

4.2.5.1 5-pin Mini-Style connector (7/8")



♦ *Fig. 4-5: Preparing the power supply cable*

ATTENTION:
Reverse polarity of the power supply can cause damage to the module.

4.2.5.2 Connecting the power supply to the module

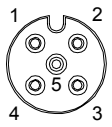
Auxiliary power supply is required for actuators and sensors. The MVK-MI electronics are supplied from the sensor power supply.

The sensor power supply may not be of the switchable type as this voltage supplies power to the module electronics!

ATTENTION:
The 7/8" plug connector is designed for max. 9 A current per pin. This must be taken into account for downstream power supply.

In order to reduce the power loss upon the incoming cable from the power supply to the MVK-MI module is recommended a 1,5mm² wire gauge. The recommended wire gauge from the MVK-MI module to the actuators is 0,75mm².

4.2.6 Connection of digital sensors and encoder



♦ *Fig. 4-6: M12 socket assignment*

Pin 1	+ 24 V	Sensor supply
Pin 2	Function channel 1x	Parameterizable channel
Pin 3	0 V	Reference potential
Pin 4	Function channel 0x	Parameterizable channel
Pin 5	FE	Ground

Any sockets not in use must be fitted with blind caps, as IP 67 protections is otherwise not guaranteed.

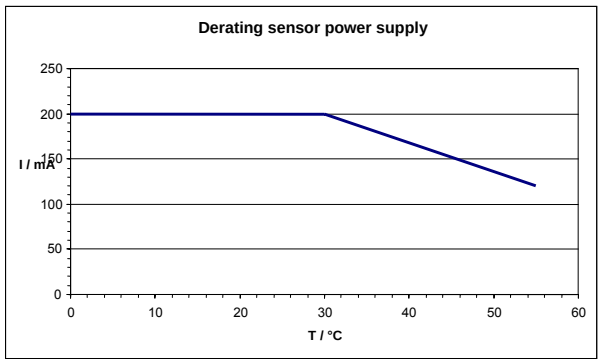
4.2.6.1 Logical signal display and LED response

Normally open input	Voltage at input	Logical value	LED display[1]
	0 V	0	OFF
	24 V	1	Yellow
Normally closed input	0 V	1	OFF
	24 V	0	Yellow
Diagnosis input	0 V	1	Red
	24 V	0	OFF

Output	Logical value	Voltage at output	LED display
	0	0 V	OFF
	1	24 V	Yellow

4.2.6.2 Sensor power supply

Sensors can be supplied via pin 1 (+24V) and pin 3 (0V) of the M12 sockets. A re-settable PTC per M12 socket protects the sensor supply. The max. current draw for sensor power supply is 200 mA for each M12 socket. Please note the following derating diagram.



[1] If a channel-related diagnosis is active, the LED assigned to this channel will light up red.

4.2.6.3 Actuators

Each output can be loaded to a maximum of 1.6 A.

Maximum output current per port 3,2A (each 1,6A) <= 40°C room temperature.
Maximum output current per port 2,8A (each 1,6A) <= 55°C room temperature.

Attention:
The sum current may not exceed 9 A due to the maximum current carrying capacity of the power connector.
When routing the actuator power supply forward, please assure that the sum current of all modules does not exceed 9 A.

Attention:
Reverse polarity of the actuator power can damage the module!

Attention:
The module may heat, depending on the load!

If an overload or short-circuit occurs at an output, that output will be disabled. This output will remain disabled even when the error has been corrected. In order to reset the short-circuit memory, the output must be switched off at the control.

Targeting a fast short circuit shutdown time is recommended to not exceed the following cable lengths:
max 15m incoming cable 1,5mm² and max 1,5m actuator cable 0,75 mm²
max 10m incoming cable 1,5mm² and max 3m actuator cable 0,75 mm²

4.2.6.4 Diagnosis input

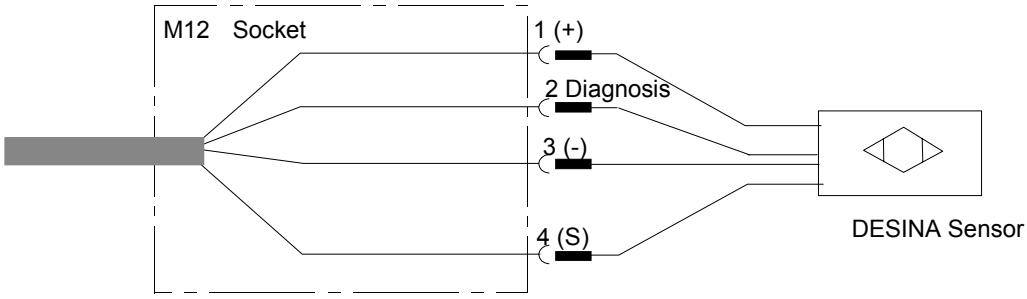
Pin 2 of the M12 socket can be parametered as a diagnosis input on all modules. If a 0 volt signal is present at a diagnosis input, it will be inversely displayed in the process map. At the same time, the Interbus diagnosis will issue a channel-specific diagnostic message.

4.2.6.4.1 Examples of using the diagnosis function at Pin 2

When Pin 2 is parametered as a diagnosis input, it always responds as an inverted input. This means that in the case of 0 V -> logic "1" the assigned LED will light up red. This allows external device errors to be displayed at the MVK-MI. Several possible examples are presented below.

4.2.6.4.1.1 Connecting sensors and actuators with diagnosis output

For this example, assume that a sensor or actuator with a diagnosis output is being used. This diagnostic signal can also be evaluated with a conventional I/O system. It can be processed and displayed in the control.
However, you have no visual error display near the defective sensor which, moreover, is probably also mounted in a non-visible location. The optical display at the M12 socket of the MVK-MI facilitates exact on-site location of the error.

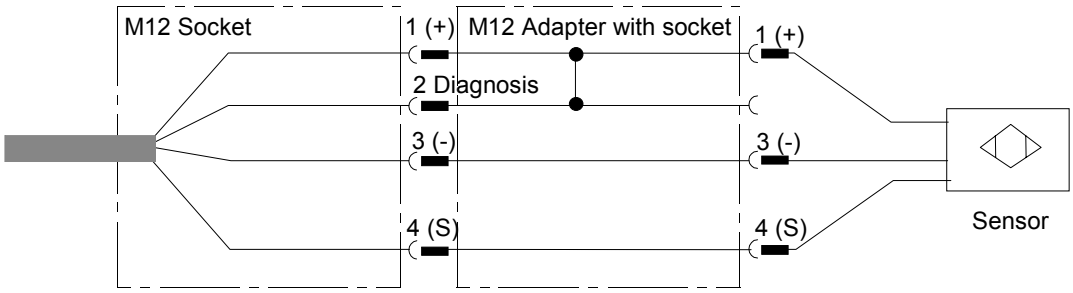


Detection of:

- *Front surface damage*
- *Defective electronics*
- *Open-Load*

4.2.6.4.1.2 Cable breakage monitoring

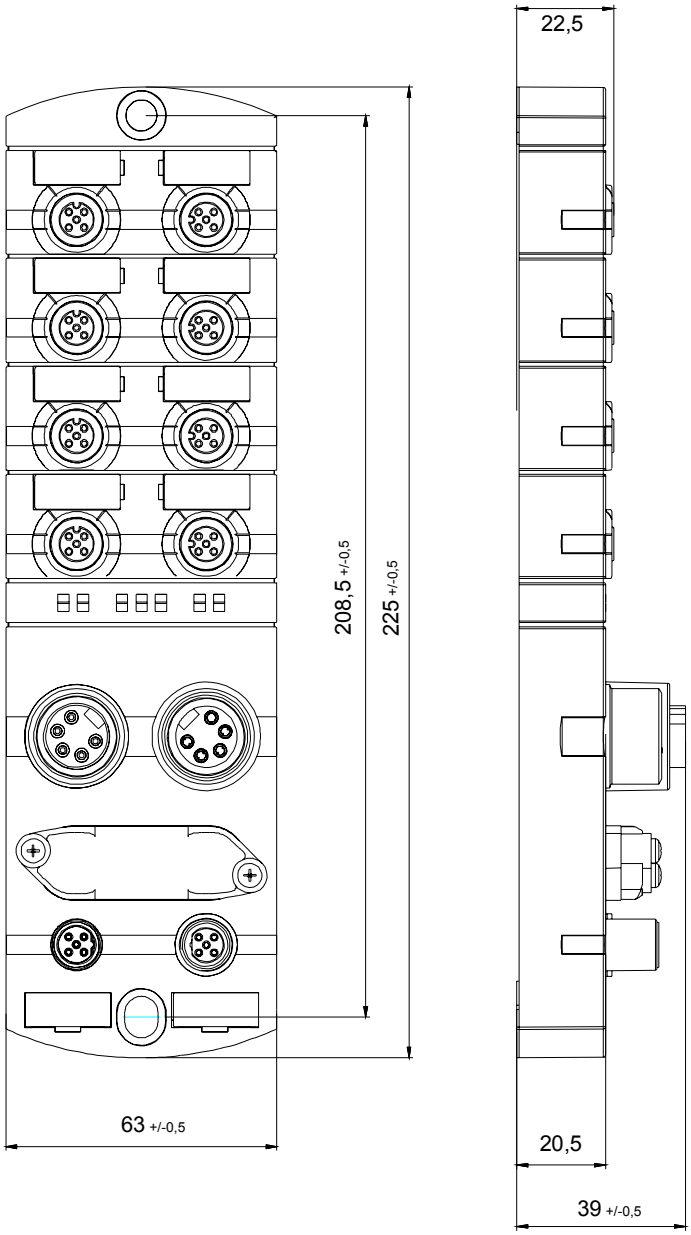
With the M12 diagnostic adapter, Murrelektronik GmbH offers a simple tool for monitoring the M12 cables to the sensors or actuators for cable breakage.



4.3 Installation

Modules of the MVK-MI series can be attached directly to an installation panel or to a machine. The module features two mounting holes for this purpose.

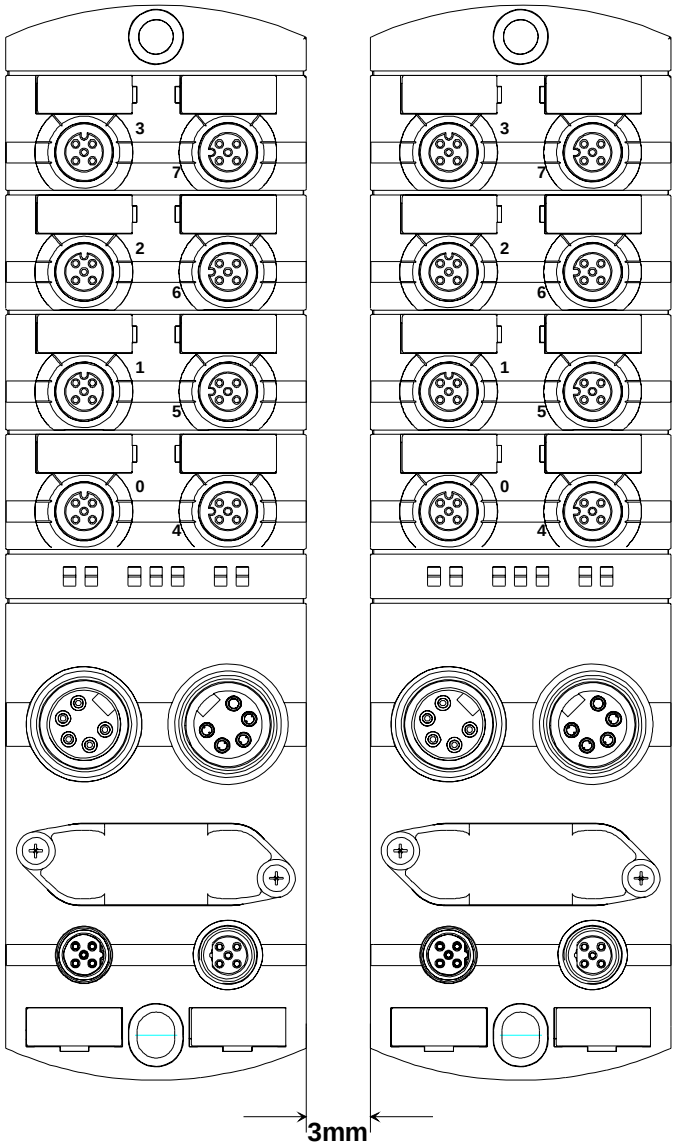
Before attaching the module, it must be assured that the mounting surface is smooth and flat to prevent mechanical stress in the module housing.
Two mounting screws 6 mm in diameter and two lock washers DIN 433 T_1/T_2 are needed for attachment. The tightening torque is 9 Nm.



♦ *Fig. 4-7: Attachment dimensions*

4.4 Installation clearance

For adequate installation and improved heat dissipation we recommend that the assembly of MVK MI be kept at a minimum distance of 3 mm to keep.



♦ *Fig. 4-8*: *Installation clearance*

4.5 Electromagnetic compatibility (EEC)

CE

This device complies with EC directives 89/336/EWG
"Electromagnetic compatibility"

Warning!
This is Class A equipment. Installation in residential areas can result in radio interference; in such cases, the operator / owner can be required to take appropriate counter measures.
This can result in damage to the module.

The devices described in this user's manual already conform to relevant EMC standards. Despite this, however, it must not be assumed that their electromagnetic compatibility in an installation is guaranteed.

The user is therefore strongly advised to adhere to the following information on EMC-suitable installation. Only under these conditions and the exclusive use of CE rated components can compliance with EMC requirements be assumed for the total system.

Responsibility for compliance with EMC regulations rests entirely with the system manufacturer.

4.5.1 Protection against electrostatic discharge

The products described in this manual contain complex semi-conductor components that can be damaged or destroyed through electrostatic discharge (ESD). Damage does not necessarily lead to an immediately detectable failure or malfunction. This can also occur with delay or sporadically.

When handling the devices, please observe the generally familiar safety measures for handling ESD-sensitive equipment. The following deserves special attention:

Attention:
Connectors must never be pulled or plugged in while the equipment is under power.

Personnel entrusted with the installation must be electrostatically discharged prior to handling the equipment. This can be accomplished by either touching a grounded part of the installation or by wearing a correctly grounded ESD wrist strap.

4.5.2 Grounding

A short, low impedance connection between the grounding terminal and ground is needed in order to draw off interference voltages occurring between the device and ground. The inductivity of conventional PE cables is a source of high impedance for high frequency interference voltages. For this reason the use of grounding strips is preferred. If this is not possible use fine-stranded PE cable of large cross-section and keep the distance to earth as short as possible.

4.5.3 Cable routing

Non-compliance with elementary rules of cable routing is a common cause of EMC problems!

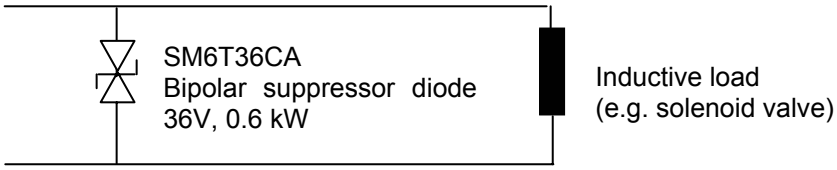
- ✓ The Interbus data cable must be kept as far away as possible from power cables.
- ✓ A minimum distance of 10 mm must be observed.
- ✓ Data cables and power cables should cross each other only at right angles.
- ✓ It is recommended to lay data and power cables in separate, screened troughs.
- ✓ Potential interference from other devices or cables must also be taken into consideration in cable routing. The greatest possible distance must be maintained especially from frequency converters, motor cables and other devices or cables emitting high frequency interference.

4.5.4 Voltage drops

The electronics power supply is buffered by integrated capacitors so that short-term voltage drops will not usually affect normal operation. This does not apply to the actuator power supply as their high power requirements cannot be buffered with integrated capacitors. Even short-term actuator power interruptions can therefore result in undesired switching operations.
Thanks to the integrated input filters, interruption of the sensor supply voltage < 1 ms does not result in any change to the input status reported to the Interbus Master. Lengthier sensor supply interruptions, however, can lead to input signal changes.

4.5.5 Inductive load interference suppression

The outputs of the devices described in this manual feature an integrated surge protection circuit against the interference voltage that arises when inductive devices are switched.



The suppressor diode assures rapid reduction of the energy stored in the inductive load magnetic field. Unlike varistors, safety circuits with suppressor diodes offer two important advantages:

- ✓ No aging
- ✓ Rapid reaction response

The high voltages that occur when switching OFF inductive loads result in potent fields in the cables which in turn may cause interference in neighboring circuits or devices. For this reason we recommend using additional load-drain circuits when there is a greater distance between module output and load or when other factors are involved. This has the effect that the voltage peaks induced by the inductive load are drained at source.

Murrelektronik GmbH offers an extensive array of interference suppression products for this purpose.

4.5.6 Limits and what can still be done...

As the EMC within the system is also influenced by the products of other manufacturers, it is conceivable that there will be system configurations where interference emission and noise immunity requirements can be met only through additional efforts or not at all.

- ✓ Line filters are suitable for reducing power related interference.
- ✓ Various manufacturers offer fiber optic converters. Data transmission through fiber optic cables is less sensitive to EMC interference. This does not, however, apply to the electronics required for the conversion. Fiber optics cannot therefore solve all EMC related problems.

Should you have any further questions regarding EMC or require advice on fulfilling the EMC directives in your installation, please contact our accredited test center.

MURRELEKTRONIK Test Center
Grabenstr. 27
D-71 570 Oppenweiler
Tel.:07191 / 47 – 320
Fax: 07191 / 47 – 323
Pruefzentrum@murrelektronik.de

5 Diagnosis displays

Diagnostic information is an important prerequisite for easy setup and quick troubleshooting.

♦ *Fig. 5-1: MVK-MI module diagnosis displays*

Errors can be quickly identified and rectified through clear information regarding the field bus system, the I/O module and connected peripheral components such as sensors and actuators. This minimizes downtimes.

All MVK-MI series modules feature separate, clearly arranged displays for bus status, device status and I/O status. These displays are located on the front of the module-housing.

5.1 Bus / Device status displays

The LED's on the face of the module are marked for clear information identification and represent a static status LED display.

LED	Color	Status	Description
U_L		On	Power supply for module electronics is connected
RC	Green	On	The incoming remote bus connection is O.K. (Remote Bus Check)
BA	Green	On	Data transmission with the master is active (Bus Active)
RD	Yellow	On	Downstream field bus disconnected (Remote Bus Disabled)
U_S	Green	On	Power supply for sensors is connected and over 18V
	Red		Power supply for sensors is under 18V
UA_L	Green	On	Power supply for left actuators is connected and over 18V
	Red		Power supply for actuators is under 18V
UA_R	Green	On	Power supply for right actuators is connected and over 18V
	Red		Power supply for right actuators is under 18V

♦ *Table 5-1 : Bus-/Device – Status display*

6 Interbus word structure

When using the following table please keep in mind that the MVK-MI system transmits two words. Each word contains two bytes arranged in the Big-Endian format (higher value byte first).

When using the CMD software, simply orient yourself on the third column "Byte" in the following table. This represents the structure as displayed in the process data monitor.

6.1 MVK-MI DI8(DI8) Art.Nr. 55294

Word	Bit	Byte	Bit	Input	Output
Word 0	8	Byte 0	0	Channel 00 (Socket 0 / Pin 4)	reserved (default=0)
	9		1	Channel 01 (Socket 1 / Pin 4)	reserved (default=0)
	10		2	Channel 02 (Socket 2 / Pin 4)	reserved (default=0)
	11		3	Channel 03 (Socket 3 / Pin 4)	reserved (default=0)
	12		4	Channel 04 (Socket 4 / Pin 4)	reserved (default=0)
	13		5	Channel 05 (Socket 5 / Pin 4)	reserved (default=0)
	14		6	Channel 06 (Socket 6 / Pin 4)	reserved (default=0)
	15		7	Channel 07 (Socket 7 / Pin 4)	reserved (default=0)
	0	Byte 1	0	Channel 10 (Socket 0 / Pin 2)	reserved (default=0)
	1		1	Channel 11 (Socket 1 / Pin 2)	reserved (default=0)
	2		2	Channel 12 (Socket 2 / Pin 2)	reserved (default=0)
	3		3	Channel 13 (Socket 3 / Pin 2)	reserved (default=0)
	4		4	Channel 14 (Socket 4 / Pin 2)	reserved (default=0)
	5		5	Channel 15 (Socket 5 / Pin 2)	reserved (default=0)
	6		6	Channel 16 (Socket 6 / Pin 2)	reserved (default=0)
	7		7	Channel 17 (Socket 7 / Pin 2)	reserved (default=0)
Word	**Bit**	**Byte**	**Bit**		
Word 1	8	Byte 2	0	Undervoltage U_{Sensor}	reserved (default=0)
	9		1	Undervoltage $U_{Actuator,0..3}$	reserved (default=0)
	10		2	Undervoltage $U_{Actuator,4..7}$	reserved (default=0)
	11		3	Sensor supply short circuit	reserved (default=0)
	12		4	reserved	reserved (default=0)
	13		5	reserved	reserved (default=0)
	14		6	reserved	reserved (default=0)
	15		7	reserved	reserved (default=0)
	0	Byte 3	0	Periphery error Socket 0	Channel 10 Diagnose (0) / Input (1)
	1		1	Periphery error Socket 1	Channel 11 Diagnose (0) / Input (1)
	2		2	Periphery error Socket 2	Channel 12 Diagnose (0) / Input (1)
	3		3	Periphery error Socket 3	Channel 13 Diagnose (0) / Input (1)
	4		4	Periphery error Socket 4	Channel 14 Diagnose (0) / Input (1)
	5		5	Periphery error Socket 5	Channel 15 Diagnose (0) / Input (1)
	6		6	Periphery error Socket 6	Channel 16 Diagnose (0) / Input (1)
	7		7	Periphery error Socket 7	Channel 17 Diagnose (0) / Input (1)

ID-Code	**03_{hex} (03_{dec})**
Length code	**02_{hex} (02_{dec})**
Input address space	**4 bytes**
Output address space	**4 bytes**
Parameter channel (PCP)	**0 bytes**
Register length (Bus)	**4 byte**

6.2 MVK-MI DIO8(DIO8) Art.Nr. 55295

Word	Bit	Byte	Bit	Input	Output
Word 0	8	Byte 0	0	Channel 00 (Socket 0 / Pin 4)	Channel 00 (Socket 0 / Pin 4)
	9		1	Channel 01 (Socket 1 / Pin 4)	Channel 01 (Socket 1 / Pin 4)
	10		2	Channel 02 (Socket 2 / Pin 4)	Channel 02 (Socket 2 / Pin 4)
	11		3	Channel 03 (Socket 3 / Pin 4)	Channel 03 (Socket 3 / Pin 4)
	12		4	Channel 04 (Socket 4 / Pin 4)	Channel 04 (Socket 4 / Pin 4)
	13		5	Channel 05 (Socket 5 / Pin 4)	Channel 05 (Socket 5 / Pin 4)
	14		6	Channel 06 (Socket 6 / Pin 4)	Channel 06 (Socket 6 / Pin 4)
	15		7	Channel 07 (Socket 7 / Pin 4)	Channel 07 (Socket 7 / Pin 4)
	0	Byte 1	0	Channel 10 (Socket 0 / Pin 2)	reserved (default=0)
	1		1	Channel 11 (Socket 1 / Pin 2)	reserved (default=0)
	2		2	Channel 12 (Socket 2 / Pin 2)	reserved (default=0)
	3		3	Channel 13 (Socket 3 / Pin 2)	reserved (default=0)
	4		4	Channel 14 (Socket 4 / Pin 2)	reserved (default=0)
	5		5	Channel 15 (Socket 5 / Pin 2)	reserved (default=0)
	6		6	Channel 16 (Socket 6 / Pin 2)	reserved (default=0)
	7		7	Channel 17 (Socket 7 / Pin 2)	reserved (default=0)
Word	**Bit**	**Byte**	**Bit**		
Word 1	8	Byte 2	0	Undervoltage U_{Sensor}	reserved (default=0)
	9		1	Undervoltage e $U_{Actuator,0..3}$	reserved (default=0)
	10		2	Undervoltage $U_{Actuator,4..7}$	reserved (default=0)
	11		3	Sensor supply short circuit	reserved (default=0)
	12		4	Actuator disable Socket 0..3	reserved (default=0)
	13		5	Actuator disable Socket 4..7	reserved (default=0)
	14		6	Actuator warning	reserved (default=0)
	15		7	reserved	reserved (default=0)
	0	Byte 3	0	Periphery error Socket 0	Channel 10 Diagnose (0) / Input (1)
	1		1	Periphery error Socket 1	Channel 11 Diagnose (0) / Input (1)
	2		2	Periphery error Socket 2	Channel 12 Diagnose (0) / Input (1)
	3		3	Periphery error Socket 3	Channel 13 Diagnose (0) / Input (1)
	4		4	Periphery error Socket 4	Channel 14 Diagnose (0) / Input (1)
	5		5	Periphery error Socket 5	Channel 15 Diagnose (0) / Input (1)
	6		6	Periphery error Socket 6	Channel 16 Diagnose (0) / Input (1)
	7		7	Periphery error Socket 7	Channel 17 Diagnose (0) / Input (1)

ID-Code	03_{hex} (03_{dec})
Length code	02_{hex} (02_{dec})
Input address space	4 bytes
Output address space	4 bytes
Parameter channel (PCP)	0 bytes
Register length (Bus)	4 bytes

The output status is not reported back via the input word!
Parameterization between input and output takes place implicitly through description of the output bit (Word 0). If an output is not set, this means that parameterization as an input has been made.

6.3 MVK-MI DIO8(DIO8) Art.Nr. 55296

Word	Bit	Byte	Bit	Input	Output
Word 0	8	Byte 0	0	Channel 00 (Socket 0 / Pin 4)	Channel 00 (Socket 0 / Pin 4)
	9		1	Channel 01 (Socket 1 / Pin 4)	Channel 01 (Socket 1 / Pin 4)
	10		2	Channel 02 (Socket 2 / Pin 4)	Channel 02 (Socket 2 / Pin 4)
	11		3	Channel 03 (Socket 3 / Pin 4)	Channel 03 (Socket 3 / Pin 4)
	12		4	Channel 04 (Socket 4 / Pin 4)	Channel 04 (Socket 4 / Pin 4)
	13		5	Channel 05 (Socket 5 / Pin 4)	Channel 05 (Socket 5 / Pin 4)
	14		6	Channel 06 (Socket 6 / Pin 4)	Channel 06 (Socket 6 / Pin 4)
	15		7	Channel 07 (Socket 7 / Pin 4)	Channel 07 (Socket 7 / Pin 4)
	0	Byte 1	0	Channel 10 (Socket 0 / Pin 2)	Channel 10 (Socket 0 / Pin 2)
	1		1	Channel 11 (Socket 1 / Pin 2)	Channel 11 (Socket 1 / Pin 2)
	2		2	Channel 12 (Socket 2 / Pin 2)	Channel 12 (Socket 2 / Pin 2)
	3		3	Channel 13 (Socket 3 / Pin 2)	Channel 13 (Socket 3 / Pin 2)
	4		4	Channel 14 (Socket 4 / Pin 2)	Channel 14 (Socket 4 / Pin 2)
	5		5	Channel 15 (Socket 5 / Pin 2)	Channel 15 (Socket 5 / Pin 2)
	6		6	Channel 16 (Socket 6 / Pin 2)	Channel 16 (Socket 6 / Pin 2)
	7		7	Channel 17 (Socket 7 / Pin 2)	Channel 17 (Socket 7 / Pin 2)
Word	**Bit**	**Byte**	**Bit**		
Word 1	8	Byte 2	0	Undervoltage U_{Sensor}	reserved (default=0)
	9		1	Undervoltage $U_{Actuator,0..3}$	reserved (default=0)
	10		2	Undervoltage $U_{Actuator,4..7}$	reserved (default=0)
	11		3	Sensor supply short circuit	reserved (default=0)
	12		4	Actuator disable Socket 0..3	reserved (default=0)
	13		5	Actuator disable Socket 4..7	reserved (default=0)
	14		6	reserved	reserved (default=0)
	15		7	reserved	reserved (default=0)
	0	Byte 3	0	Periphery error Socket 0	Channel 10 Diagnose (0) or E/A (1)
	1		1	Periphery error Socket 1	Channel 11 Diagnose (0) or E/A (1)
	2		2	Periphery error Socket 2	Channel 12 Diagnose (0) or E/A (1)
	3		3	Periphery error Socket 3	Channel 13 Diagnose (0) or E/A (1)
	4		4	Periphery error Socket 4	Channel 14 Diagnose (0) or E/A (1)
	5		5	Periphery error Socket 5	Channel 15 Diagnose (0) or E/A (1)
	6		6	Periphery error Socket 6	Channel 16 Diagnose (0) or E/A (1)
	7		7	Periphery error Socket 7	Channel 17 Diagnose (0) or E/A (1)

ID-Code	03_{hex} (03_{dec})
Length code	02_{hex} (02_{dec})
Input address space	4 bytes
Output address space	4 bytes
Parameter channel (PCP)	0 bytes
Register length (Bus)	4 bytes

The output status is not reported back via the input word!
Parameterization between input and output takes place implicitly through description of the output bit (Word 0). If an output is not set, this means that parameterization as an input has been made.

7 Parameterization

Parameterization of the MVK-MI is accomplished via cyclical user data exchange. The parameter data is transferred together with the output data. The PCP[2] channel is not supported. Devices with PCP support can, however, be operated together with the MVK-MI system on a common Interbus line.

7.1 Parameterization of Pin 2 as an input or diagnosis input

Parameter	Values	Significance
Channel 1x Input / Diagnose	0	Diagnosis
	1	Input

Pin 2 parameterized as a diagnosis input

Power at Pin 2	LED 10..17	Interbus data	Interpretation
0 V	Red	1	Desina-Diagnosis / External error / cable breakage
24 V	OFF	0	No error / OK

Pin 2 parameterized as an input

Power at Pin 2	LED 10..17	Interbus data	Interpretation
0 V	OFF	0	-
24 V	Yellow	1	-

7.2 Implicit parameterization as a digital input or digital output

Every M12 socket has two pins that can be used either for input or output signals. The use of pin 2 and/or pin 4 of the M12 socket can be determined by describing the outputs.

16 channels (pin 2 / pin 4) are available on eight M12 socket connectors. Each of these channels can be independently defined to function as either an input or an output. For Pin 2, you can additionally define whether that channel should function as a digital input or as a diagnosis input.

By setting the corresponding bit at the output, the respective pin will be seen as an output and issue 24V. The voltage at the output is, at the same time, read in by the module and reported in Interbus word 0.

When the output at the same bit is now set to 0, the actual voltage at the pin is still measured and reported via Interbus word 0. If a signal coming from a sensor is present at this pin, its status ("0" or "1") is reported.

[2] Peripherals Communication Protocol

8 Technical data

8.1 Mechanical data

8.1.1 DI8(DI8) Art.Nr. 55 294, DIO8(DI8) Art.Nr. 55 295, DIO8(DIO8) Art.Nr. 55 296

Technical data	DI8(DI8) Art.Nr. 55 294	DIO8(DI8) Art.Nr. 55 295	DIO8(DIO8) Art.r. 55 296
Ambient conditions			
Operating temperature	0°C...55°C		
Storage temperature	-25°C...75°C		
Flammability classification	UL 94 V0		
Chemical and oil resistance	Good chemical and oil resistance. When using aggressive mediums, material resistance based on application must be checked.		
Materials			
Housing	Zinc die cast, matt nickel coated		
Contact mount M12	SPS (UL94 V0), black		
Contact mount 7/8"	TPE PA 6.6 (UL94 V2), black		
Contact	CuZn, nickel and gold plated		
O-Ring M12	Viton, green		
O-Ring 7/8"	NBR, black		
Luminous comb + ring	PC		
Mechanical data			
Insertion force / contact			
Withdrawal force / contact	≥ 0.4 N		
Plugging cycles / contact	≤ 50		
Enclosure type EN 60629	IP 67 (only when plugged and screwed down)		
Vibration, sine shaped EN 60068-2-6	Floating sine 10 to 60 Hz: Amplitude 0.35 mm Floating sine 60 to 500 Hz: Acceleration 15 g *		
Shock, half-sine shaped	Shock duration 11 ms Shock acceleration 50 g *		
Design information			
Dimensions (LxWxH)			
Mounting clearance	208.5 ±0.5 mm		
Weight	ca. 735 g		
Torques	220 x 63 x 48 mm		
Round connector M12	0.6 Nm		
Mounting screws M6	9 Nm		
Connection possibilities			
Supply cables			
Profibus	M12 connectors (B-coded) 5-pin		
I/O cables	8 x M12 round connectors (A-coded) 5-pin		

* Validated with vibration 20g according to EN 60068-2-27 and shock 80g according to MIL STD-800

8.2 Electrical data

Technical data	DI8(DI8) Art.Nr. 55 294	DIO8(DI8) Art.Nr. 55 295	DIO8(DIO8) Art.r. 55 296
Max. number of inputs	16	16[3]	16[3]
Max. number of outputs	-	8	16[3]
Operating voltage	24V DC ± 25%		
Current consumption	<150 mA		
Sensor supply			
Max. current	max. 200 mA per M12 socket		
Overload/Short circuit Fuse	Multi-fuse (PTC) (For each M12 socket)	<= 100 mA > 100 mA	Automatic re-start Reset required
	Trip time 1 s at I_k >= 1 A und 23°C ambient temperature		
Reverse polarity protection			
- Module electronics	Yes		
- Sensors	No		
- Actuators	No		
Outputs			
Rated current	-	1.6 A	1.6 A
Max. sum current	-	9 A	9 A
Overvoltage protection	Yes (Suppressor diode)		
Cable length		0.75 mm²	Max. 10 m
		0.34 mm²	Max. 5 m
Conductor cross section	Max. 1.5 mm²		
Signal delay	2 to 5 ms		
Max. switch frequency at inductive load	20 Hz		
Max. lamp load	10 W		
Inputs			
Input characteristic curve	IEC 1131-2, Type 2		
Input filter	approx. 1 ms		
Signal delay	2 to 5 ms		
Overvoltage protection	Yes (suppressor diode)		
EMC			
EN 50082 / EN 50081	EN 61000-4-2 ESD	Contact ± 4 kV ; Air ± 8 kV	
	EN 61000-4-3 RF-field	10 V/m	
	EN 50204 RF-field GSM	10 V/m	
	EN 61000-4-4 Burst	± 2 kV	
	EN 61000-4-5 Surge	Asym./sym. ± 0.5 kV DC line input	
		Asym. ± 1 kV Signal connections	
	EN 61000-4-6 RF-asymmetric	10 V	
	EN 61000-4-8 Magnetic field 50 Hz	30 A/m	
	EN 50081-1 Interference strength	QP 40 dBµV/m (30-230 MHz)	
		QP 47 dBµV/m (230-1000 MHz)	
Insulation	DIN VDE 0160		
Rated voltage	IEC 60664-1		
Test voltage			
Insulation resistance	IEC 60512-2		
Volume resistance	≤ 5 mΩ		
Profibus			
Supported Baud rates	9.6 / 19.2 / 45.45 / 93.75 / 187.5 / 500 / 1500 / 3000 / 6000 / 12000 kBaud		
Protocol	Profibus DP according to IEC 61158		
Operating modes	Sync-Mode and Freeze-Mode are supported		
Id. number	064A hex		
Profibus address	1 – 99 selectable via BCD rotary switch		

[3] Depending on parameterization. The sum of inputs and outputs is always 16.

9 Accessories

Art. No.	Description
55 294	MVK-MI DI8 (DI8)
55 295	MVK-MI DIO8 (DI8)
55 296	MVK-MI DIO8 (DIO8)
55 468	M12 blind plugs, black (set of 4)
33 8155	M12 diagnosis blind plugs, black (1 x)
33 8008	M12 diagnosis adapter
55 771	Interbus remote bus cable (per meter)
55 387	MVK-MI Manual (German/English/French)

55387_hdb_e_10.doc

10 Description of terms

Actuator disable

If an output driver is overloaded or has a short-circuit, it is disabled by an integrated thermal monitor. The software of the MVK-MI prevents the output driver from being reactivated automatically after cooling down. Otherwise, the output driver would be switched on/off alternately in the case of overload or short circuit. No defined response would be possible. During an overload or short circuit, therefore, the output driver is switched permanently off until the user process resets the output. This deletes the short-circuit memory.

Sensor supply short circuit

The sensor power supply of each M12 socket is individually protected by means of a 200 mA Multi-fuse. A short circuit or overload in the sensor supply of one M12 socket therefore does not affect the sensors or module electronics supplied through other M12 sockets.

Periphery error

Error message relating to individual M12 sockets; this message combines the individual errors "actuator disable" and "sensor supply short circuit". Pin 2 diagnosis according to DESINA is NOT included in the periphery error but is separately transferred in the input data for pin 2.

Pin 2 diagnosis

The diagnosis output of an intelligent sensor or actuator can be connected to pin 2. An "OK" status is always assigned to status "1" (24 V), as this is the only way breakage of a diagnostic signal cable can be recognized as an error. The diagnosis input inverts the signal and indicates the error condition via a red LED at the M12 socket.